REVIEW AND BIBLIOGRAPHY OF SECONDARY ION MASS SPECTROMETRY (S-ION)
A REVIEW AND BIBLIOGRAPHY OF SECONDARY ION MASS SPECTROMETRY (SIMS)

W. L. Baun
Mechanics and Surface Interactions Branch
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A REVIEW OF SECONDARY ION MASS SPECTROMETRY (SIMS)

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ABSTRACT:
Secondary ion mass spectrometry (SIMS) is reviewed. Fundamental concepts of SIMS including the advantages and disadvantages are shown. Surface disturbances and fundamental collision phenomenon are discussed. Equipment is shown for SIMS, including the mass analyzer and the energy analyzer. Types of mass spectra are discussed including aspects of initial energy and energy distribution. Selection and use of atomic or polyatomic spectra are discussed along with molecular fingerprint spectra. Ion yield, an important aspect of...
20. Continued

SIMS analysis, is seen to be heavily influenced by oxygen either in the primary beam or on the surface. The advantages and limitations of depth profiling by SIMS are shown. Methods of neutralizing the positive charge accumulation on the surface are discussed. Two methods of imaging secondary ions are detailed and a combination of the SEM with SIMS is also discussed. The increasing popularity of SIMS is seen to be primarily due to the complementary nature of this technique with other surface methods. Applications of the method either as a stand-alone technique or in use with other techniques are seen to be very diverse.
FOREWORD

This technical report was prepared by W. L. Baun, Mechanics and Surface Interactions Branch, Nonmetallic Materials Division, Air Force Materials Laboratory (AFML/MBM). This work was initiated under Project 2419, "Nonmetallic and Composite Materials" and was administered by the Air Force Materials Laboratory. Work Unit Directive Monitor was T. W. Haas.

This report covers literature collected over the period June 1978 to June 1979 in the area of secondary ion mass spectrometry which is used to characterize adhesive bonding materials. The report was released by the author in June 1979.
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SECTION I

INTRODUCTION

If a solid surface is bombarded by energetic ions, a complex process of energy transfer and electronic interaction occur in the surface and near surface of the solid. As a result of these interactions at the surface, electrons and atomic and molecular particles are ejected and photons are emitted. The interaction of the energetic ions with the solid results in the transfer of energy to ions and atoms in the solid and subsequent ejection of both neutral and ionized species.

The first SIMS experiments were performed in the late 1930's by Arnot and co-workers (Reference 1). The technique lay essentially fallow until 1949 when Herzog and Viehbock (Reference 2) described an ion source for mass spectrometry using the sputtering process, but even after this brief resurgence, it was almost ten years until further interest was evidenced by workers in this field. Honig (Reference 3) in 1958 began a rise of interest in the SIMS technique which widened during the 1960's. Reviews of early literature were published by Carter and Colligon (Reference 4) and Kaminsky (Reference 5). More modern reviews with emphasis on the SIMS technique as applied to surface analysis, have been authored by Benninghoven (Reference 6) and Werner (Reference 7). It is the purpose of this review to discuss fundamental concepts, advantages and disadvantages of SIMS for surface analysis along with collision phenomenon, such as sputtering and implantation. Equipment for the SIMS method will be briefly described. Aspects of secondary ion mass spectra will be considered including the species of the secondary ions, the ion yield, and experimental parameters. The complementary nature of SIMS to other surface characterization methods will be discussed. Finally, applications of the SIMS method will be considered. Appendices concerning nomenclature, isotopic abundances, and the sources of information on SIMS are included.
When a surface is bombarded with ions, atomic and molecular particles, electrons and photons are emitted from the surface as seen in Table 1 (Benninghoven). The ion as it strikes the surface and penetrates into the solid can undergo numerous collision processes, as seen in Figure 1 (Winters). The process under consideration here is No. 5 as seen in Figure 1; the reflected ion giving energy to a surface atom which is sputtered. A review of experimentation and theory of physical sputtering was prepared by Winters (Reference 8). The sputtering species, which are moved from the surface, are made up of both positive and negative ions, as well as neutral particles. Neutral particles have much greater abundance than ionic species and have also been used for surface analysis.

### TABLE 1

**EFFECT OF ION IMPACT ON A SOLID SURFACE INCLUDING EMISSION PROCESSES & CHANGES IN THE SURFACE ZONE**

<table>
<thead>
<tr>
<th>EMISSION PROCESSES</th>
<th>CHANGES IN THE SURFACE OF THE TARGET</th>
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<tbody>
<tr>
<td>Atomic and molecular particles</td>
<td>Loss of surface particles</td>
</tr>
<tr>
<td>Neutrals</td>
<td>Sputtering</td>
</tr>
<tr>
<td>Positive ions</td>
<td>Recoil implantation</td>
</tr>
<tr>
<td>Negative ions</td>
<td></td>
</tr>
<tr>
<td>Excited particles</td>
<td></td>
</tr>
<tr>
<td>Electrons</td>
<td>Implantation</td>
</tr>
<tr>
<td>Surface processes (Auger de-excitations, e.g.)</td>
<td>Primary ions</td>
</tr>
<tr>
<td>Bulk processes (ionization, e.g.)</td>
<td>Surface atoms (recoil)</td>
</tr>
<tr>
<td>Photons</td>
<td>Lattice destruction</td>
</tr>
<tr>
<td>Gas phase processes</td>
<td>Imperfections</td>
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<tr>
<td>Surface processes</td>
<td>Amorphization</td>
</tr>
<tr>
<td>Bulk processes</td>
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Figure 1. Schematic of Possible Collision Processes which Occur Under Ion Bombardment (Reference 8)
Surface analysis by SIMS falls into two categories: low current density sputtering and high current density sputtering. Categories are determined by the characteristics of the primary ion beam. A low current density sputtering analysis results in a very small fraction of the surface being disturbed, a result that approaches a basic requirement of a true surface analysis method. This is generally known as the static SIMS method (SSIMS). High current density sputtering removes a great deal of material, but is required for obtaining elemental depth profiles. In the high current density method, significant changes are seen in the surface and near surface regions. Table 2 (Benninghoven) shows the effect of ion impact on a solid surface including the emission process and changes in the surface zone. Figure 2 (Benninghoven) also shows schematically the induced changes in the surface zone of a solid due to ion bombardment and shows three different zones: an emission zone, an implantation zone, and a lattice destruction zone. These zones then are defined as A) a loss of surface atoms out of the emission zone as a consequence of emission of molecular and atomic particles and recoil implantation; B) implantation of primary ions and recoil surface atoms; C) changes in the lattice structure, as for example, creation of imperfections, amorphous states and so forth. In addition, other low energy processes, such as the breaking of chemical bonds and the formation of chemical bonds, are also caused by ion bombardment. The escape depth for sputtered particles varies greatly and is strongly dependent on the energy of the primary ion, the mass of the primary ion, and the mass of the atoms of the target. To determine whether a particle will leave the surface as a neutral species or as an ion is a complex, quantum mechanical problem involving ground and excited state interactions of the atom or molecule with the solid. Numerous workers (Werner (Reference 7), McHugh (Reference 9), Benninghoven (Reference 6)) have discussed possible mechanisms for emission of secondary ions. Joyes (Reference 10) has reviewed the theoretical mechanisms of secondary ion emission. For moderate energy sputter ion beams, a major contributor to the secondary ion yield is resonance and autoionization of excited species that emerge from the solid phase to vacuum. A less important contribution to the ion yield is resonance ionization of ground state species. An explanation by Schroeer (Reference 11) for the emission of positive ions from metals assumes that
TABLE 2
MAIN FEATURES OF SIMS AS A SURFACE ANALYSIS METHOD (REFERENCE 6)

<table>
<thead>
<tr>
<th>Positive</th>
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<tr>
<td>- Information depth in the &quot;monolayer range&quot;</td>
<td></td>
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<tr>
<td>- Detection of all elements including hydrogen</td>
<td></td>
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<tr>
<td>- Detection of chemical compounds</td>
<td></td>
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<tr>
<td>- &quot;Lateral resolution&quot; in the range of atomic distances</td>
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<tr>
<td>- Isotope separation</td>
<td></td>
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<tr>
<td>- Extremely high sensitivity for many elements and compounds (&lt;10^-6 monolayers)</td>
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<tr>
<td>- Quantitative analysis after calibration</td>
<td></td>
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<tr>
<td>- Negligible destruction of the surface (SSIMS)</td>
<td></td>
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<td>- Elemental Profiling (Dynamic SIMS)</td>
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<td>- Large differences in sensitivity for different &quot;surface structures&quot; (factor 1000)</td>
<td></td>
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<tr>
<td>- Problems in quantitative interpretation of molecular spectra</td>
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<tr>
<td>- Ion induced surface reactions</td>
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Figure 2. Induced Changes in the Surface Zone Due to Sputtering (Reference 6)
the sputtered particle leaves the surface as a neutral atom in the ground state and is ionized via transition of the atom electrons to the top of the conduction band in the metal.

Regardless of the exact mechanism and production, the SIMS method as a technique for surface analysis has several advantages as seen in Table 2 (Benninghoven). Of the positive attributes listed probably the extremely high sensitivity for many elements is the greatest advantage of SIMS. On the other hand, the extremely large differences in sensitivity for different surface structures is the largest negative factor involved in SIMS analysis. More specifically, the following comments on the SIMS technique were aired by Czanderna and co-workers (Reference 12) in a recent review.

1. DETECTION SENSITIVITY

The outstanding feature of SIMS is the detection sensitivity of $10^{-6}$ to $10^{-4}$ of a monolayer for surface analysis, depending on how fast the surface has sputtered away. Except for slight variations in the transmissivity of ions with different masses, there is no $Z$ dependence on the detection sensitivity of a properly designed SIMS apparatus. Furthermore, the absence of an inherent background permits detection of trace amounts of $10^{-2}$ to 1 ppm atomic. As little as $10^{-18}$ grams of the sample species may be sufficient to provide a detectable signal. Thus, using care in the instrument and bombardment parameters, signals may be restricted to one to two monolayers.

2. ISOTOPIC IDENTIFICATION

Isotopic labeling of ions could be used for study of reaction mechanisms. Despite the apparent potential, the literature contains little mention of isotopic labeling in conjunction with SIMS analysis of the surface.

3. IDENTIFICATION OF HYDROGEN

The detectability of hydrogen by SIMS provides a routinely available capability not possible with other commercially available surface analysis equipment.
4. CHEMICAL IDENTIFICATION

The complex spectra presented provide an opportunity to unravel chemical information about surface compounds.

5. IN-DEPTH PROFILING

The ability to sputter surfaces rapidly and to maintain a constant monitor of the composition is one of the outstanding features of SIMS. As with any depth profiling process resolution at the interface is limited by the damage caused by sputtering rather than by the apparatus.

6. IMAGING

Ion microprobes provide capability to image the surface under investigation. Czanderna and co-workers also make some pertinent comments on limitations of the SIMS method. They point out that first and foremost SIMS requires destruction of the sample for analysis. There is no chance for a second look at the same spot on the sample. Secondly, the factors causing large variations in the production of secondary ions make routine quantification only a remote hope. Using standards and well-studied systems, quantitative SIMS to better than the 20% of the surface layers is possible, but the cost of extensive prior work may not be warranted. Finally, matrix effects, e.g., the variation in the signal of the same element in different chemical environments can alter the detectability of trace amounts by factors of $10^2$ to $10^4$. 
SECTION III
EQUIPMENT

All SIMS experiments require a vacuum chamber to house the experiment, a sample holder, an ion source, an energy analyzer, and a mass analyzer as seen in Figure 3. Use of the characteristics of imaging instruments have been made by Socha (Reference 13) and fundamental concepts of both imaging and non-imaging instruments by McHugh (Reference 9). Most non-imaging instruments are generally called SIMS instruments. Imaging instruments are usually called ion microprobes. A schematic of a typical ion microprobe mass analyzer is shown later in the discussion of imaging. Usually such imaging instruments have vacuum capabilities in the very high vacuum region rather than in the UHV. Also used are high sputtering rates and ion voltages in the range of 10 kv or more. This is in contrast to new designs for SIMS using quadrupole mass analyzers where vacuum capabilities in the range of $10^{-10}$ Torr are possible. In the static SIMS method where very slow sputtering rates are used for analysis, the capabilities must be such that the recontamination rate for residual gases do not exceed the sputtering rate. SIMS instruments also vary according to the total pressure in the system. In most instruments the noble or reactive gas fills the system and the entire chamber, including the ion gun and sample area, are at approximately 1 to $5 \times 10^{-5}$ Torr. Such an instrument is typified by the commercial equipment manufactured by the 3M Co. (3M Co., St. Paul, Minnesota). Another type of instrument is one in which the performance is improved through the use of a differentially pumped vacuum system to produce ultra high vacuum in the vicinity of the sample. This also allows the entry of a reactive gas in the sample chamber area while sputtering with a noble ion for studying chemical changes or reactions on the surface. An instrument of this type from the recent literature (Reference 15) is shown in Figure 4. Still another improvement made to the SIMS instruments is the mass analysis of the primary beam (Reference 16). Such an instrument design is shown in Figure 5. In addition to mass analyzing the primary beam is this instrument, beams less than 70 micrometers in diameter are used with current densities
Figure 3. Major Components of a SIMS Experiment

Figure 4. A General View of the Secondary Ion Mass Spectrometer System (Reference 15)
greater than 25 milliamperes per square centimeter. Beam rastering and electronic signal gating make this instrument especially applicable to the production of high quality depth profiles. These authors point out that an ultra high vacuum system is an absolute necessity to reduce the adsorption of background gases on the sample surface during sputtering for in-depth profiling of carbon, oxygen, nitrogen, and especially hydrogen.

The energy filter is made up generally of several elements whose function is to optimize collection of the secondary ions, and to filter and focus the ions at the entrance to the mass analyzer. The energy analyzer as used by Dawson and Redhead is seen in Figure 6. The grid radii are chosen to increase the acceptance angle at the target and to produce a converging beam at the quadrupole mass analyzer entrance. An interesting design utilizing conically shaped elements was developed by Dowsett et al (Reference 17). Magee and co-workers (Reference 16) used a spherical electrostatic analyzer in front of the quadrupole elements to allow selection of specific areas in the crater and the use of an on-axis electron multiplier in the quadrupole mass analyzer. Much simpler designs also perform well, such as the two analyzers seen in Figure 7.

Secondary ions may be mass analyzed with virtually any kind of mass spectrometer. Most imaging instruments use double focusing mass spectrometers. The majority of modern secondary ion mass spectrometers for surface characterization use quadrupole mass filters. Some use a dual
Figure 6. Detail Showing the Arrangement of the Energy Analyzer (Reference 17)

Figure 7. Simple Energy Analyzers
system in which a magnetic sector is used to separate the primary ions and a quadrupole is used to detect secondary ions as shown in Figure 8 (Reference 26).

The radio frequency quadrupole mass analyzer has a number of advantages for secondary ion mass spectroscopy. Among the inherent characteristics of the quadrupole filter are: A) Particle separation is on the basis of charge to mass ratio rather than on other properties, such as velocity or momentum; B) Axial energy acceptance is over a relatively wide range; and C) Transmission efficiency approaches 100% under certain operating conditions. One attractive aspect of the quadrupole is that only radio frequency fields are required making the analyzer relatively light and structurally compact compared to magnetic instruments. Operating design also allows very rapid spectrum scanning rates (orders of magnitude greater than most magnetic instruments). This allows a real-time oscilloscope display of SIMS data. In addition, the geometry of the quadrupole is such that only an external ionizer is needed to provide residual gas analysis (RGA) capability.

Figure 8. Magnetic Sector Design to Separate Primary Ions (Reference 26)
SECTION IV
SECONDARY ION MASS SPECTRA

Benninghoven (Reference 18) used a simple two-component lattice of metal and oxygen to answer the question "What types of ions will be emitted from a given surface structure?" During the sputtering process, particles of this lattice will be emitted from the surface, both as single atoms and as clusters. Plog, Wiedman, and Benninghoven (Reference 27) evaluated data from oxidized metals and established a formula which allows calculation of absolute yields of metal and oxygen ions. Benninghoven (Reference 18) makes the assumption that one condition of the formation of a cluster is that the cluster atoms are located on adjacent sites of the lattice before emission. It was printed out that in the case of a metal-oxygen lattice, we can expect particles of the composition \( \text{Me}_m\text{O}_n \). This way a matrix of possible clusters was established. The formation probability of a particle cluster is a complicated function of many parameters, such as the charge state of an emitted ion. In principle, each fragment can be ejected as a positively or negatively charged ion or as a neutral particle. In the case of the metal oxygen surface structures, it has been learned from experimental results that for emitted particles there is a tendency for charge conservation related to the charge state in the lattice (Reference 18). Therefore, we should expect the preferential emission of positive metal ions \( \text{Me}^+ \) and negative oxygen ions \( \text{O}^- \) for a metal-oxygen structure. The yield of secondary molecular ions depends on the electronic properties of the molecular ion, particularly the dissociation energy of the complex. Joyes (Reference 10) has used semi-empirical quantum chemical calculations to explain a number of experimental observations relating to relative molecular ion yields. Instruments not using ultra high vacuum or instruments using reactive sputtering frequently show many more molecular ions than those in which noble gas ions are used in an ultra high vacuum system. Elements with many isotopes frequently combine to form extremely complicated spectra. Werner (Reference 7) points out that it is most advantageous for chemical analysis to work in a mode which preferably gives atomic ions; on the other hand, he says that for studies of chemical
bonding, polyatomic ions, which constitute the fingerprint spectrum of a
given compound, can be used to advantage. Molecular ions may be dis-
criminated from atomic ions because of the different energy distribution
of the two groups. The energy spectrum of the distribution of \( \text{Al}_3^+ \) and
\( \text{Al}^+ \) is much different, as shown by Herzog and co-workers (Reference 19).
An illustration of their work using discrimination on initial energy
distribution is shown in Figure 9. By setting an energy band, one can
favorably increase the intensity of the atomic species, such as \( \text{Al}^+ \), with
respect to the cluster ion, such as \( \text{Al}_3^+ \). On the other hand, the cluster
ions can be used as a clue to the molecular species on the surface, and
the method has been extended into the analysis and characterization of
organic materials. This makes this technique invaluable for studying
the adsorption characteristics of various surfaces to liquids and gaseous
compounds. An example of a negative SIMS spectrum of adsorbed molecules
is shown in Figure 10 (Reference 6).

More recent results have been shown and are summarized in Table 3
on a variety of materials such as vitamins, peptides, and amino acids
(Reference 28). An example of positive and negative secondary ion spectra
is shown for ascorbic acid in Figure 11.
Figure 9. Energy Distribution of Secondary Ions and Spectra from Each Region (Reference 19)
Surface oxidation to the corresponding acid is possible only for the secondary alcohol (C₃H₇COO emission, upper spectrum)

Figure 10. Secondary Ion Spectrum of Adsorbed Molecules: 1- & 2-Butanol on Molybdenum (Reference 6)
### TABLE 3

ABSOLUTE YIELD OF "PARENT LIKE" SECONDARY IONS OF ORGANIC COMPOUNDS ON SILVER (REFERENCE 28)

<table>
<thead>
<tr>
<th>I. amino acid</th>
<th>formula</th>
<th>mol wt</th>
<th>yield $S(X) \times 100$ L</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>(Number of secondary ions x 100, per incident primary ion)</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>$(M + H)^+$</td>
<td>$(M - H)^-$</td>
<td>$(M - COOH)^-$</td>
</tr>
<tr>
<td>glycine</td>
<td>C$_4$H$_7$NO$_2$</td>
<td>129</td>
<td>0.0</td>
</tr>
<tr>
<td>α-alanine</td>
<td>C$_4$H$_7$NO$_2$</td>
<td>129</td>
<td>0.0</td>
</tr>
<tr>
<td>β-alanine</td>
<td>C$_4$H$_7$NO$_2$</td>
<td>129</td>
<td>0.0</td>
</tr>
<tr>
<td>phenylalanine</td>
<td>C$_5$H$_7$NO$_2$</td>
<td>167</td>
<td>0.0</td>
</tr>
<tr>
<td>serine</td>
<td>C$_4$H$_7$NO$_2$</td>
<td>129</td>
<td>0.0</td>
</tr>
<tr>
<td>threonine</td>
<td>C$_4$H$_7$NO$_2$</td>
<td>129</td>
<td>0.0</td>
</tr>
<tr>
<td>proline</td>
<td>C$_4$H$_7$NO$_2$</td>
<td>129</td>
<td>0.0</td>
</tr>
<tr>
<td>valine</td>
<td>C$_4$H$_7$NO$_2$</td>
<td>129</td>
<td>0.0</td>
</tr>
<tr>
<td>leucine</td>
<td>C$_4$H$_7$NO$_2$</td>
<td>129</td>
<td>0.0</td>
</tr>
<tr>
<td>norleucine</td>
<td>C$_4$H$_7$NO$_2$</td>
<td>129</td>
<td>0.0</td>
</tr>
<tr>
<td>arginine</td>
<td>C$_4$H$_7$NO$_2$</td>
<td>129</td>
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</tr>
<tr>
<td>tyrosine</td>
<td>C$_5$H$_7$NO$_2$</td>
<td>167</td>
<td>0.0</td>
</tr>
<tr>
<td>tryptophan</td>
<td>C$_6$H$_7$NO$_2$</td>
<td>205</td>
<td>0.0</td>
</tr>
<tr>
<td>cysteine</td>
<td>C$_4$H$_7$NO$_2$</td>
<td>129</td>
<td>0.0</td>
</tr>
<tr>
<td>cystine</td>
<td>C$_4$H$_7$NO$_2$</td>
<td>129</td>
<td>0.0</td>
</tr>
<tr>
<td>methionine</td>
<td>C$_7$H$_7$NO$_2$</td>
<td>149</td>
<td>0.0</td>
</tr>
<tr>
<td>ethionine</td>
<td>C$_7$H$_7$NO$_2$</td>
<td>149</td>
<td>0.0</td>
</tr>
<tr>
<td>glutamine</td>
<td>C$_4$H$_7$NO$_2$</td>
<td>129</td>
<td>0.0</td>
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<table>
<thead>
<tr>
<th>II. derivatives of amino acids</th>
<th>formula</th>
<th>mol wt</th>
<th>yield $S(X) \times 100$ L</th>
</tr>
</thead>
<tbody>
<tr>
<td>Glycine ethylester HCl</td>
<td>C$_5$H$_7$NO$_2$</td>
<td>139</td>
<td>1.6</td>
</tr>
<tr>
<td>Alanine ethylester HCl</td>
<td>C$_5$H$_7$NO$_2$</td>
<td>139</td>
<td>1.6</td>
</tr>
<tr>
<td>Cysteine HCl</td>
<td>C$_7$H$_7$NO$_2$</td>
<td>149</td>
<td>4.0</td>
</tr>
<tr>
<td>Taurine</td>
<td>C$_7$H$_7$NO$_2$</td>
<td>149</td>
<td>4.0</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>III. peptides</th>
<th>formula</th>
<th>mol wt</th>
<th>yield $S(X) \times 100$ L</th>
</tr>
</thead>
<tbody>
<tr>
<td>Glycylglycine</td>
<td>C$_8$H$_8$NO$_2$</td>
<td>178</td>
<td>4.0</td>
</tr>
<tr>
<td>Glycylglycylglycine</td>
<td>C$_8$H$_8$NO$_2$</td>
<td>178</td>
<td>4.0</td>
</tr>
<tr>
<td>Phenylalanylglycine</td>
<td>C$_8$H$_8$NO$_2$</td>
<td>178</td>
<td>4.0</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>IV. drugs</th>
<th>formula</th>
<th>mol wt</th>
<th>yield $S(X) \times 100$ L</th>
</tr>
</thead>
<tbody>
<tr>
<td>Barbital</td>
<td>C$_5$H$_7$NO$_2$</td>
<td>151</td>
<td>44.0</td>
</tr>
<tr>
<td>Ephedrine</td>
<td>C$_5$H$_7$NO$_2$</td>
<td>151</td>
<td>44.0</td>
</tr>
<tr>
<td>Atropine</td>
<td>C$_5$H$_7$NO$_2$</td>
<td>151</td>
<td>44.0</td>
</tr>
<tr>
<td>Epinephrine</td>
<td>C$_5$H$_7$NO$_2$</td>
<td>151</td>
<td>44.0</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>V. vitamins</th>
<th>formula</th>
<th>mol wt</th>
<th>yield $S(X) \times 100$ L</th>
</tr>
</thead>
<tbody>
<tr>
<td>Ascorbic acid (C)</td>
<td>C$_5$H$_7$O$_2$</td>
<td>176</td>
<td>3.7</td>
</tr>
<tr>
<td>Biotin (H)</td>
<td>C$_5$H$_7$NO$_2$</td>
<td>176</td>
<td>3.7</td>
</tr>
<tr>
<td>Nicotinic acid (PP)</td>
<td>C$_5$H$_7$NO$_2$</td>
<td>176</td>
<td>3.7</td>
</tr>
<tr>
<td>Nicotinamide</td>
<td>C$_5$H$_7$NO$_2$</td>
<td>176</td>
<td>3.7</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>VI. sulfonamides</th>
<th>formula</th>
<th>mol wt</th>
<th>yield $S(X) \times 100$ L</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sulfanilic acid</td>
<td>C$_5$H$_7$NO$_2$</td>
<td>176</td>
<td>3.7</td>
</tr>
<tr>
<td>Sulfanilamide</td>
<td>C$_5$H$_7$NO$_2$</td>
<td>176</td>
<td>3.7</td>
</tr>
<tr>
<td>Sulfacetamide</td>
<td>C$_5$H$_7$NO$_2$</td>
<td>176</td>
<td>3.7</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>VII. other compounds</th>
<th>formula</th>
<th>mol wt</th>
<th>yield $S(X) \times 100$ L</th>
</tr>
</thead>
<tbody>
<tr>
<td>Thymidine</td>
<td>C$_5$H$_7$NO$_2$</td>
<td>176</td>
<td>3.7</td>
</tr>
<tr>
<td>Acriflavine</td>
<td>C$_5$H$_7$NO$_2$</td>
<td>176</td>
<td>3.7</td>
</tr>
<tr>
<td>Creatine</td>
<td>C$_5$H$_7$NO$_2$</td>
<td>176</td>
<td>3.7</td>
</tr>
</tbody>
</table>

| Notes                        |         |        |                           |
| M                         | Mass of related amino acid. |
| *                         | Identical with $(M' + H)^+$ |
| **                        | $(M' + H, O)^+$ |

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Figure 11. SIMS Data from Ascorbic Acid (Reference 28)
Unknown or rapidly changing secondary ion yields are the major problem confronting the SIMS technique. Factors influencing secondary ion yield are the complex electronic and chemical properties of the surface along with certain characteristics of the matrix, and the concentration of the active species. The absolute secondary ion yields for certain elements, such as aluminum, chromium, and vanadium may change by as much as a factor of $10^3$ from a clean metal condition to a fully oxidized surface (Reference 20). In addition, according to McHugh (Reference 9), the relative ion yields for different elements in the same matrix can exceed $10^4$, and in single crystals the secondary ion yield can vary with crystal orientation. Ion channeling phenomenon in single crystals can also complicate this situation. Ion yield can vary greatly with the impinging ion. Of course, it has been shown that sputtering yield of ions and neutrals is dependent on the mass and the energy of the primary ion beam. Evidence of this is shown in Figure 12 from the work of Winters (Reference 8), where the sputtering yield for copper is calculated and compared with experimental data for neon on copper, argon on copper, and xenon on copper. The increase in sputtering yield is seen with an increase in mass of the primary ion. There is also a very large influence on the sputtering yield with the angle of incidence, as shown in Figure 13, for argon ions on polycrystalline copper (Reference 8). Yields are also greatly influenced by the reactivity of gas making up the primary ion beam. This is shown in Figure 14 (Socha, Figure 7) where the yield of $\text{Al}^+$ is shown as a function of time using argon and oxygen. In the case of argon, there is a very fast rising spike in the yield which corresponds to the natural oxide on aluminum. The yield drops off rapidly as the natural oxide film is removed. Bombardment with oxygen, on the other hand, shows the same rapid rise, and then reaches an equilibrium sputtering rate which continues because of the reactivity of the oxygen ion beam. This method of increasing ion yields has been used by sputtering with noble gas ions onto a surface in which a very small jet of oxygen or other reactive gas is directed. This allows the
Figure 13. Variation of Sputtering Yield with Angle of Incidence for Ar\(^+\) Ions on Polycrystalline Copper

Figure 14. Al\(^+\) Yield Using Argon and Oxygen Ions (Reference 13)
use of noble gas ion sputtering for which the sputtering rates are well known and yet has the advantage of keeping sputtering rates constant. One must remember either when sputtering with reactive gases or when adding a reactive gas to increase the yield that the surface chemistry is being changed, and that the true surface characterization of the original surface is not being obtained. However, for certain purposes such as producing sharp in-depth profile analysis which are not subject to yield changes, such a technique must be employed. Many authors have shown tables of data in which the secondary ion yield of positive and negative species and of clean metals and pure oxides have been determined. Such data is seen in Tables 4 and 5. Generally, these tables give approximate values but the yields are so dependent on aspects such as the partial pressure of reactive and unreactive gases in a system that probably standards must be run in a particular system to obtain even secondary standard samples. Yield data for Ar$^+$ and Xe$^+$ at higher voltage (8 KV) are shown in Table 6 (Reference 13). Despite the fact that absolute values of ion yield may not be the same as measured in another system, it is extremely useful to have even semi-quantitative data available. Numerous measurements have been made on the yield of both clean and oxide covered surfaces. Yields have also been measured with both noble gas and reactive gas sputtering. In the earlier and following tables, yields for both clean and oxide covered surfaces for both positive and negative species are shown taken primarily from the work of Werner (Reference 7) and of Benninghoven (Reference 6). In addition, measurement of Benninghoven (Reference 27) on the yields of the secondary ions of the species MeOn$^+$ is given for 15 oxidized elements. Also, calculated values are shown of the lowest detectable concentration for several elements assuming a primary ion beam current of $10^{-8}$ ampere. The energy dependence of the secondary ion yield is seen in Figure 15 from work of Wittmaack (Reference 3). Calculations by Werner (Reference 7) show the relation between ion current erosion rate, thickness of the removed layer, and the minimum detectable limit in Table 10.
### TABLE 4

**RELATIVE YIELDS OF SOME ELEMENTS FOR THE FORMATION OF NEGATIVE IONS, $S_{rel}^-$, OF POSITIVE IONS, $S_{rel}^+$, AND THE RATIO $S_{rel}^-/S_{rel}^+$ (REFERENCE 29)**

<table>
<thead>
<tr>
<th></th>
<th>Al</th>
<th>Fe</th>
<th>Ge</th>
<th>Zr</th>
<th>Cu</th>
<th>Pt</th>
<th>Ag</th>
<th>Pb</th>
<th>Au</th>
</tr>
</thead>
<tbody>
<tr>
<td>$S_{rel}^-$</td>
<td>4.4</td>
<td>12</td>
<td>1</td>
<td>6.6</td>
<td>1.4</td>
<td>2.4</td>
<td>0.2</td>
<td>0.2</td>
<td>7.4</td>
</tr>
<tr>
<td>$S_{rel}^+$</td>
<td>15.4</td>
<td>0.9</td>
<td>0.6</td>
<td>0.35</td>
<td>0.13</td>
<td>0.05 (0.5)</td>
<td>0.04</td>
<td>0.02</td>
<td></td>
</tr>
<tr>
<td>$S_{rel}^-/S_{rel}^+$</td>
<td>0.29</td>
<td>13.3</td>
<td>1.6</td>
<td>10</td>
<td>10</td>
<td>4.8 (40)</td>
<td>5.5</td>
<td>370</td>
<td></td>
</tr>
</tbody>
</table>

* reference element: iron

### TABLE 5

**POSITIVE ION YIELDS FOR CLEAN METAL AND OXIDE SURFACE (REFERENCE 7)**

<table>
<thead>
<tr>
<th>ELEMENT</th>
<th>$S^+$clean</th>
<th>$S^+$</th>
<th>$S^+$oxide</th>
<th>$S^+$</th>
<th>$S^+$oxide/$S^+$clean</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mg</td>
<td>8.5 x 10^{-3}</td>
<td>4 x 10^{-3}</td>
<td>1.6 x 10^{-3}</td>
<td>8 x 10^{-3}</td>
<td>20</td>
</tr>
<tr>
<td>Al</td>
<td>2 x 10^{-3}</td>
<td>1 x 10^{-2}</td>
<td>2</td>
<td>1</td>
<td>100</td>
</tr>
<tr>
<td>V</td>
<td>1.3 x 10^{-3}</td>
<td>7 x 10^{-4}</td>
<td>1.2</td>
<td>6 x 10^{-4}</td>
<td>10^3</td>
</tr>
<tr>
<td>Cr</td>
<td>5 x 10^{-2}</td>
<td>3 x 10^{-3}</td>
<td>1.2</td>
<td>6 x 10^{-4}</td>
<td>200</td>
</tr>
<tr>
<td>Fe</td>
<td>1 x 10^{-3}</td>
<td>5 x 10^{-4}</td>
<td>3.8 x 10^{-3}</td>
<td>2 x 10^{-3}</td>
<td>380</td>
</tr>
<tr>
<td>Ni</td>
<td>3 x 10^{-3}</td>
<td>2 x 10^{-4}</td>
<td>2 x 10^{-3}</td>
<td>1 x 10^{-3}</td>
<td>7</td>
</tr>
<tr>
<td>Cu</td>
<td>1.3 x 10^{-3}</td>
<td>7 x 10^{-4}</td>
<td>4.5 x 10^{-3}</td>
<td>2 x 10^{-3}</td>
<td>30</td>
</tr>
<tr>
<td>Sr</td>
<td>2 x 10^{-4}</td>
<td>1 x 10^{-4}</td>
<td>1.3 x 10^{-4}</td>
<td>7 x 10^{-4}</td>
<td>700</td>
</tr>
</tbody>
</table>

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TABLE 6
ION YIELDS FOR SOME PURE ELEMENTS OBTAINED BY USING XENON AND ARGON PRIMARY IONS (REFERENCE 13)

<table>
<thead>
<tr>
<th>Metal</th>
<th>Xe</th>
<th>Ar</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mg</td>
<td>20.9</td>
<td>100</td>
</tr>
<tr>
<td>Al</td>
<td>7.2</td>
<td>760</td>
</tr>
<tr>
<td>Fe</td>
<td>4.2</td>
<td>22.6</td>
</tr>
<tr>
<td>Co</td>
<td>1.5</td>
<td>3.2</td>
</tr>
<tr>
<td>Ni</td>
<td>1.68</td>
<td>1.8</td>
</tr>
<tr>
<td>Cu</td>
<td>0.79</td>
<td>2.4</td>
</tr>
<tr>
<td>Zn</td>
<td>0.95</td>
<td>3.2</td>
</tr>
<tr>
<td>Zr</td>
<td>0.56</td>
<td>3.0</td>
</tr>
<tr>
<td>Nb</td>
<td>0.09</td>
<td>3.7</td>
</tr>
<tr>
<td>Ag</td>
<td>0.01</td>
<td>0.94</td>
</tr>
<tr>
<td>Cd</td>
<td>0.38</td>
<td>0.11</td>
</tr>
<tr>
<td>In</td>
<td>1.67</td>
<td>5.0</td>
</tr>
<tr>
<td>Sn</td>
<td>0.72</td>
<td>1.0</td>
</tr>
<tr>
<td>Ta</td>
<td>1</td>
<td>1</td>
</tr>
<tr>
<td>Au</td>
<td>0.006</td>
<td>0.008</td>
</tr>
<tr>
<td>Pb</td>
<td>3.0</td>
<td>4.2</td>
</tr>
</tbody>
</table>

TABLE 7
ABSOLUTE SECONDARY ION YIELDS S(Me⁺) FOR CLEAN AND OXYGEN COVERED SURFACES (REFERENCE 7)

<table>
<thead>
<tr>
<th>Metal</th>
<th>S(Me⁺) Clean surface</th>
<th>S(Me⁺) Oxygen covered surface</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mg</td>
<td>0.01</td>
<td>0.9</td>
</tr>
<tr>
<td>Al</td>
<td>0.007</td>
<td>0.7</td>
</tr>
<tr>
<td>Ti</td>
<td>0.0013</td>
<td>0.4</td>
</tr>
<tr>
<td>V</td>
<td>0.001</td>
<td>0.3</td>
</tr>
<tr>
<td>Cr</td>
<td>0.0012</td>
<td>1.2</td>
</tr>
<tr>
<td>Mn</td>
<td>0.0006</td>
<td>0.35</td>
</tr>
<tr>
<td>Fe</td>
<td>0.0015</td>
<td>0.35</td>
</tr>
<tr>
<td>Ni</td>
<td>0.0006</td>
<td>0.045</td>
</tr>
<tr>
<td>Cu</td>
<td>0.0003</td>
<td>0.007</td>
</tr>
<tr>
<td>Sr</td>
<td>0.0002</td>
<td>0.16</td>
</tr>
<tr>
<td>Nb</td>
<td>0.0006</td>
<td>0.05</td>
</tr>
<tr>
<td>Mo</td>
<td>0.00065</td>
<td>0.4</td>
</tr>
<tr>
<td>Ba</td>
<td>0.0002</td>
<td>0.03</td>
</tr>
<tr>
<td>Ta</td>
<td>0.000007</td>
<td>0.02</td>
</tr>
<tr>
<td>W</td>
<td>0.00009</td>
<td>0.035</td>
</tr>
<tr>
<td>Si</td>
<td>0.0084</td>
<td>0.58</td>
</tr>
<tr>
<td>Ge</td>
<td>0.0044</td>
<td>0.02</td>
</tr>
</tbody>
</table>
TABLE 8
YIELDS OF THE OXIDE-SPECIFIC SECONDARY IONS $\text{MeO}_n^+$ FOR 15 OXIDIZED METAL SURFACES (REFERENCE 27)

<table>
<thead>
<tr>
<th>Metal</th>
<th>Ref.</th>
<th>$\text{Mg}^+$</th>
<th>$\text{MeO}^+$</th>
<th>$\text{MeO}_2^+$</th>
<th>$\text{MeO}_3^+$</th>
<th>$\text{MeO}_4^+$</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mg</td>
<td>[24]</td>
<td>$9.0 \times 10^{-1}$</td>
<td>$1.5 \times 10^{-3}$</td>
<td>(a)</td>
<td>$1.0 \times 10^{-2}$</td>
<td>$2.5 \times 10^{-2}$</td>
</tr>
<tr>
<td>Al</td>
<td>[17,27]</td>
<td>$7.0 \times 10^{-1}$</td>
<td>$6.0 \times 10^{-3}$</td>
<td>(a)</td>
<td>$2.0 \times 10^{-2}$</td>
<td>$2.0 \times 10^{-2}$</td>
</tr>
<tr>
<td>Ti</td>
<td>[25]</td>
<td>$4.0 \times 10^{-1}$</td>
<td>$5.0 \times 10^{-3}$</td>
<td>$7.0 \times 10^{-3}$</td>
<td>(a)</td>
<td>$5.0 \times 10^{-3}$</td>
</tr>
<tr>
<td>V</td>
<td>[21]</td>
<td>$3.0 \times 10^{-1}$</td>
<td>$6.0 \times 10^{-3}$</td>
<td>$1.0 \times 10^{-3}$</td>
<td>(a)</td>
<td>$2.0 \times 10^{-3}$</td>
</tr>
<tr>
<td>Cr</td>
<td>[19,20]</td>
<td>$1.2 \times 10^0$</td>
<td>$2.0 \times 10^{-3}$</td>
<td>$2.5 \times 10^{-3}$</td>
<td>(a)</td>
<td>$1.8 \times 10^{-3}$</td>
</tr>
<tr>
<td>Mn</td>
<td>[27]</td>
<td>$3.0 \times 10^{-1}$</td>
<td>$7.0 \times 10^{-3}$</td>
<td>(a)</td>
<td>$4.0 \times 10^{-3}$</td>
<td>$3.0 \times 10^{-2}$</td>
</tr>
<tr>
<td>Fe</td>
<td>[18,26]</td>
<td>$3.0 \times 10^{-1}$</td>
<td>$1.4 \times 10^{-2}$</td>
<td>(a)</td>
<td>$7.0 \times 10^{-3}$</td>
<td>$8.5 \times 10^{-3}$</td>
</tr>
<tr>
<td>Ni</td>
<td>[25]</td>
<td>$4.5 \times 10^{-2}$</td>
<td>(a)</td>
<td>(a)</td>
<td>$7.0 \times 10^{-3}$</td>
<td>$6.0 \times 10^{-3}$</td>
</tr>
<tr>
<td>Cu</td>
<td>[25]</td>
<td>$7.0 \times 10^{-3}$</td>
<td>(a)</td>
<td>(a)</td>
<td>$1.5 \times 10^{-3}$</td>
<td>$1.5 \times 10^{-2}$</td>
</tr>
<tr>
<td>Sr</td>
<td>[24]</td>
<td>$1.6 \times 10^{-1}$</td>
<td>$3.5 \times 10^{-2}$</td>
<td>(a)</td>
<td>$1.3 \times 10^{-2}$</td>
<td>$6.0 \times 10^{-3}$</td>
</tr>
<tr>
<td>Nb</td>
<td>[21]</td>
<td>$5.0 \times 10^{-2}$</td>
<td>$3.0 \times 10^{-3}$</td>
<td>$6.0 \times 10^{-2}$</td>
<td>(a)</td>
<td>$8.0 \times 10^{-3}$</td>
</tr>
<tr>
<td>Mo</td>
<td>[27]</td>
<td>$4.0 \times 10^{-1}$</td>
<td>$3.0 \times 10^{-3}$</td>
<td>$1.7 \times 10^{-3}$</td>
<td>(a)</td>
<td>$1.4 \times 10^{-3}$</td>
</tr>
<tr>
<td>Ba</td>
<td>[24]</td>
<td>$3.0 \times 10^{-2}$</td>
<td>$1.7 \times 10^{-3}$</td>
<td>(a)</td>
<td>$9.0 \times 10^{-4}$</td>
<td>$7.0 \times 10^{-3}$</td>
</tr>
<tr>
<td>Ta</td>
<td>[21]</td>
<td>$2.0 \times 10^{-3}$</td>
<td>$2.0 \times 10^{-3}$</td>
<td>$5.0 \times 10^{-3}$</td>
<td>(a)</td>
<td>$1.0 \times 10^{-3}$</td>
</tr>
<tr>
<td>W</td>
<td>[22,23,27]</td>
<td>$3.5 \times 10^{-2}$</td>
<td>$1.5 \times 10^{-3}$</td>
<td>$1.2 \times 10^{-3}$</td>
<td>(a)</td>
<td>$1.2 \times 10^{-3}$</td>
</tr>
</tbody>
</table>

* Yield does not reach the experimental detection limit of $5 \times 10^{-5}$
TABLE 9
CALCULATED VALUES OF THE LOWEST DETECTABLE CONCENTRATION FOR SOME ELEMENTS (REFERENCE 7)

<table>
<thead>
<tr>
<th>Elements</th>
<th>$S^+$ (ppma)</th>
<th>$C_{\text{min}}$ (ppma)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cu</td>
<td>$1.3 \times 10^{-4}$</td>
<td>150</td>
</tr>
<tr>
<td>Ni</td>
<td>$3 \times 10^{-3}$</td>
<td>7</td>
</tr>
<tr>
<td>Al</td>
<td>$2 \times 10^{-2}$</td>
<td>1</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Oxides</th>
<th>$S^+$ (ppma)</th>
<th>$C_{\text{min}}$ (ppma)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cu</td>
<td>$4.5 \times 10^{-3}$</td>
<td>5</td>
</tr>
<tr>
<td>Ni</td>
<td>$2 \times 10^{-2}$</td>
<td>1</td>
</tr>
<tr>
<td>Al</td>
<td>2</td>
<td>0.01</td>
</tr>
</tbody>
</table>

Figure 15. Secondary Ion Intensity $Y^+$ versus Primary Ion Energy (Normalized to a Beam Current of 1μA) (Reference 30)
TABLE 10
RELATION BETWEEN PRIMARY ION CURRENT, EROSION RATE, THICKNESS OF REMOVED LAYER AND MINIMUM DETECTABLE CONCENTRATION (REFERENCE 7)

\[ C_{\text{min}} = \frac{1}{(z \Delta b)} \]

<table>
<thead>
<tr>
<th>Primary Ion Current ( i_p (A) )</th>
<th>Erosion Rate ( z (A \text{ s}^{-1}) )</th>
<th>Thickness of Removed Layer in ( t_a = 200 \text{ s} )</th>
<th>( C_{\text{min}} ) (ppma)</th>
</tr>
</thead>
<tbody>
<tr>
<td>( 10^{-8} )</td>
<td>2</td>
<td>400 A</td>
<td>10</td>
</tr>
<tr>
<td>( 10^{-7} )</td>
<td>20</td>
<td>4000 A</td>
<td>1</td>
</tr>
<tr>
<td>( 10^{-6} )</td>
<td>200</td>
<td>4 ( \mu \text{m} )</td>
<td>0.1</td>
</tr>
</tbody>
</table>

Bombarded area \( A_b : 100 \text{ \( \mu \text{m} \) (10\(^{-4}\) cm\(^2\)} \)

Concl. simultaneous multi-element \( \rightarrow \) Photoplate or multi-collector detection \( \rightarrow \) (electr detection)
Statistical fluctuations - (sputtered volume)

In the SIMS technique using the ion microprobe large amounts of material are sputtered away. In SIMS experiments with standard commercial UHV instruments, less material is sputtered but still there is a good deal of disturbance of the surface. However, if we want to investigate a surface reaction on a solid without any disturbance of the reaction itself by the ion bombardment, we must choose a lifetime of the monolayer surface which is long compared with the time of ion bombardment. Therefore, the primary ion current density has to be lower and in order to compensate for this we have to bombard a large area. This technique in which the average lifetime of a single monolayer is in the order of hours, is called the static method of secondary ion mass spectroscopy (SSIMS). Benninghoven (Reference 6) reports that the detection limit of a given component in a single monolayer is between 10 and 0.01 parts per million of one monolayer.
Most SIMS instruments using quadrupole mass analyzers have at least one mass unit resolution up to mass 300 or so. This resolution is adequate for many purposes; however, if it is required to resolve some analytical ions from interfering polyatomic ions, then much higher resolution is required as shown in Table 11. (Werner (Reference 7) from unpublished data of Evans.)

TABLE 11

TYPES OF INTERFERENCES AND TYPICAL EXAMPLES (REFERENCE 7)

<table>
<thead>
<tr>
<th>Interference type</th>
<th>Interfering ion</th>
<th>Analytical ion</th>
<th>Required resolution</th>
</tr>
</thead>
<tbody>
<tr>
<td>Multiply charged matrix ion</td>
<td>$^{28}\text{Si}^{2+}$</td>
<td>$^{12}\text{C}^{+}$</td>
<td>950</td>
</tr>
<tr>
<td>Matrix ions</td>
<td>$^{12}\text{C}^{2+}$</td>
<td>$^{12}\text{C}^{0}$</td>
<td>3200</td>
</tr>
<tr>
<td>Matrix selfpolymers ions</td>
<td>$^{28}\text{Si}^{+}$</td>
<td>$^{28}\text{Si}^{+}$</td>
<td>2950</td>
</tr>
<tr>
<td>Prim. ion-matrix molecular ions</td>
<td>Cu$_2$O$^+$</td>
<td>$^{60}\text{Co}^{+}$</td>
<td>1050</td>
</tr>
<tr>
<td></td>
<td>Si$_2$O$^+$</td>
<td>$^{58}\text{Ni}^{+}$</td>
<td>3250</td>
</tr>
<tr>
<td></td>
<td>Al$_2$O$^+$</td>
<td>$^{56}\text{Fe}^{+}$</td>
<td>1500</td>
</tr>
<tr>
<td>Hydride ions</td>
<td>$^{30}\text{SiH}^+$</td>
<td>$^{31}\text{P}^+$</td>
<td>4000</td>
</tr>
<tr>
<td></td>
<td>FeH$^+$</td>
<td>$^{54}\text{Mn}^{+}$</td>
<td>3300</td>
</tr>
<tr>
<td></td>
<td>SnH$^+$</td>
<td>$^{119}\text{Sn}^{+}$</td>
<td>19500</td>
</tr>
<tr>
<td>Hydrocarbon ions</td>
<td>C$_2$H$_5$$^+$</td>
<td>$^{28}\text{Si}^{+}$</td>
<td>650</td>
</tr>
<tr>
<td></td>
<td>C$_2$H$_5$$^+$</td>
<td>$^{65}\text{Zn}^{+}$</td>
<td>650</td>
</tr>
<tr>
<td></td>
<td>C$_2$H$_2$</td>
<td>CN</td>
<td>2000</td>
</tr>
</tbody>
</table>
SECTION VI
ELEMENTAL PROFILING

In-depth elemental profiling has the ability to sputter the surface and maintain a constant monitor of the composition with depth. Such in-depth profiling may also be accomplished by ISS, AES, and PES using sputtering techniques and with other techniques such as Rutherford backscattering in which sputtering methods are not used. In addition to the use of SIMS for elemental depth profiling going into the air solid interface that method is also extremely useful for profiling through solid-solid interfaces which may be far below the surface. A great improvement in elemental depth profiling using SIMS is obtained when the ion beam is rastered generally into a square pattern and the signal is only accepted over a portion of the flat bottomed crater. This raster gate technique is diagramatically shown in Figure 16 from work of Magee et al (Reference 16). Another method of profiling with depth is to use a high intensity static beam to sputter a deep crater into a material. Then the beam is focused to a smaller size and the beam moved across the edge of the crater or the sample moved under the beam. This method allows for numerous repeat measurements of different areas around the crater, as compared to the finite length of time possible during dynamic sputtering and monitoring of a given element.

The ideal true profile is rectangular shaped with the measured profile represented by an integrated error function. The interface with delta t (in terms of sputtering time t) or delta z (in terms of depth z) is arbitrarily defined as the interval where the density drops from 84% to 16% of maximum signal, equivalent to two standard deviations (two sigma of the error curve). Alternative definitions found in the literature are based on the 90%/10% or the 95%/5% interval corresponding with 2.56 sigma or 3.29 sigma, respectively. In depth profiling, the desired quantity is concentration which is a function of depth z and must be derived from the measured intensity. Honig and Magee (Reference 23) point out that there are numerous factors which contribute to an increasing width of the interface (Reference 23), when profiling with ions. They
list the following factors which influence the interface with the
greatest degree: 1) Instrumental (inhomogeneities and fluctuating primary
beam and so forth), 2) Initial Surface Roughness (imperfection, crystal
orientation and so forth), 3) Information Depth, 4) Ion Mixing Effect
and Lattice Damage, 5) Basic Sputtering Process (statistical consider-
ations), 6) Preferential Sputtering (surface enrichment), 7) Atomic
Migration, and 8) Chemical Reaction. An example of one broadening
source is shown in Figure 20, where the AES depth profile of nickel and
chromium in a multilayer sandwich structure is shown from a smooth surface
and from a rough surface. The interfacial broadening of the rough sur-
face is seen in the AES depth profile in Figure 20.

A serious problem encountered in SIMS analysis is that of specimen
charging. Impact of energetic positive ions causes development of a
positive charge on the surface of the insulator. This charge will
influence or even prevent the emission of secondary ions. To overcome
this charging of insulators there have been numerous methods used, as
seen in Table 12. Some of these have significant limitations or
TABLE 12
METHODS OF CHANGE NEUTRALIZATION (REFERENCE 7)

(1) Deposition of a conducting thin film or of a grid.

(2) Use of $\text{Cs}^+$ as primary ions, in this way a conducting layer is continuously built up by the primary ion bombardment.

(3) Compensation of the charging by means of an extra electron beam.

(4) Use of neutral beams: the charging is reduced from the case of positive primary ions, see equation (8), to:
\[ \Delta V_n = \text{r}_{\text{is}} \] as the neutral beam does not bring any charge to the surface.

(5) Application of special electrodes for draining excessive negative charge.

(6) Shift of target holder potential $V_H$ by $\Delta V$ in a direction opposite to the previous charging of the insulator.

Contaminate the surface by coating a conductor on the surface of the insulator. In the mechanism of the charging of the insulator surface the impact of the positive ions cause secondary electron emission and consequently positive charge buildup. The obvious way of removing this charge is then to flood the surface with a beam of low energy electrons restoring charge neutrality. This method of charge compensation by electron bombardment is shown from work of Muller (Reference 22) in Figure 17. Muller's method has the advantage that deflecting the electron beam means that the surface of the sample cannot see the hot electron source and therefore cannot be contaminated by material boiled from the electron source. Since there is no direct line of sight, there is little heating caused by electrons from the filament. An example of SIMS spectra in the high mass range from an insulator when using the charge compensation method of Muller, is seen in Figure 18. Here strong, sharp symmetrical peaks are observed well out into the mass 300 range from the polymer Teflon.
Figure 17. Charge Compensation in a SIMS Instrument (Reference 22)

Figure 18. SIMS Spectrum in Mass Range 160-330 from Teflon Using Charge Neutralization (Reference 22)
The quality of the depth profile (called the depth resolution) is best described in terms of the measured width of an interface between two layers, and is represented in Figure 19. Major limitations, as seen by Honig and Magee (Reference 23), of depth profiling along with their remedies for these limitations are shown in Table 13.

1. IMAGING

Secondary ion images that provide a two-dimensional elemental characterization of the surface can be produced either by the scanning microprobe method or by the direct ion imaging method. The method of the scanning microprobe is directly analogous to the methods used in the electron microprobe. In this case, a small ion beam is scanned across the surface and the secondary ions are recorded. The spot is rastered along the surface of the sample and synchronized with a cathode ray tube (CRT), such that an ion image may be developed on the CRT. Major components for an ion microprobe mass analyzer are shown in Figure 21. Another method of producing an image could more properly be called an ion microscope. This is an instrument which combines a mass spectrometer with an ion imaging microscope. The instrument forms a surface distribution map of the elements sputtered away from the surface of the specimen. An instrument of this type is seen in Figure 22. Here an electrostatic immersion lens is used to extract the secondary ion beam and to direct it to a special mass spectrometer which has both radial transverse focusing properties. The mass spectrometer portion separates the masses so that a given atomic mass may be selected. The ion beam passes through the magnetic field's electrostatic mirror which reflects the beam back through the magnet to the exit slits. The ion beam, however, is preserved as an ion image which is then projected on an image converter which produces an equivalent electron image. This image may be displayed on a fluorescent screen for direct viewing or photographed in the same manner as with an electron microscope. The screen may also be removed and direct electronic readout may be obtained using a scintillator system.
AES Depth Profiles
Ni–Cr Multilayers

Figure 19. Depth Profile Parameters (Reference 23)

Figure 20. Influence of Roughness on Elemental Depth Profile Width and Resolution (Reference 23)
### Table 13
 LIMITATIONS AND REMEDIES IN DEPTH PROFILING (REFERENCE 23)

<table>
<thead>
<tr>
<th>MAJOR LIMITATION</th>
<th>REMEDY</th>
</tr>
</thead>
<tbody>
<tr>
<td>CONverting sputtering time ( t ) into depth ( z ) especially at interface</td>
<td>MATCH FILM TO SUBSTRATE (SIMILAR YIELDS ( Y ), RATES ( \dot{Y} ))</td>
</tr>
<tr>
<td>Converting measured intensity ( I ) into true concentration ( C )</td>
<td>SIMS: OXYGEN-FREE SYSTEM, OR SATURATE WITH ( O_2 )</td>
</tr>
<tr>
<td>Microstructure and cone formation</td>
<td>OPTICALLY FLAT SUBSTRATE</td>
</tr>
<tr>
<td>Preferential sputtering with surface enrichment</td>
<td>AMORPHOUS LAYERS, IF POSSIBLE</td>
</tr>
<tr>
<td>Excessive information depth</td>
<td>APPROPRIATE ION SPECIES (( N_2^+ ) OR ( O_2^+ ))</td>
</tr>
<tr>
<td>Lattice damage</td>
<td>SIMS RATHER THAN AES OR XPS</td>
</tr>
<tr>
<td>Chemical effects (reduction of oxides)</td>
<td>AES, XPS: CHOOSE LINE CLOSE TO MINIMUM</td>
</tr>
<tr>
<td>Mobile species in insulating matrix (e.g. ( Na/SiO_2 ))</td>
<td>SIMS: USE LOWEST FEASIBLE ION ENERGY</td>
</tr>
<tr>
<td></td>
<td>XPS: USE MINIMUM ION ENERGY, MOST SUITABLE ION SPECIES</td>
</tr>
<tr>
<td></td>
<td>CHARGE NEUTRALIZATION: BY SEPARATE ELECTRON BEAM OR ELECTRODE, OR CHOICE OF SAMPLE ANGLE</td>
</tr>
</tbody>
</table>

![Figure 21. Components of an Ion Microprobe](image)
An example of a typical ion image in this case prepared by the scanning ion microprobe is shown in Figure 23. Here the image of an aluminum grid pressed into gold (Reference 24) is shown using $^{27}$Al$^+$ ions. The picture shows an area 300 micrometers (Reference 2) and required two seconds to expose.

Another concept in imaging is shown in Figure 24 where the SIMS apparatus is coupled with a high resolution scanning electron microscope (Reference 25). Here a leak valve admits a suitable gas into the ion source region where ions are produced and accelerated at voltages up to 5 KeV. Lens assemblies permit focusing of the ion beam from less than 100 micrometers to a few millimeters diameter on the specimen surface. Deflection plates enable scanning of the ion beam for imaging or depth profile purposes. To prevent contamination from diffusion pump oils depositing on the specimen surface, a liquid nitrogen (LN$_2$) cold trap is used either surrounding the specimen or in the inlet to the diffusion pump. A gas capillary jet directed at the specimen surface may be used to reduce surface contamination from hydrocarbon pump oils. The use of oxygen in the capillary jet when a noble gas is used for sputtering also provides an active gas on the surface to maintain high and constant secondary ion yields.
Figure 23. Scanning Ion Image of an Aluminum Grid on Gold

Figure 24. SIMS/SEM Combination (Reference 25)
SECTION VII

SIMS AS A COMPLEMENT TO OTHER METHODS OF SURFACE ANALYSIS

It is recognized that SIMS has been used successfully as a stand-alone technique to solve many surface problems. However, it appears that the area of greatest use of the SIMS technique is as a complement to other surface characterization methods. The extremely high sensitivity for some elements can be taken advantage of by using SIMS with other techniques in which these elements do not show such high sensitivity. The high sensitivity of SIMS for hydrogen and low atomic number elements is a particular advantage when SIMS is used with techniques such as ion scattering. Since ion scattering and each of the other surface characterization methods in which profiling data is obtained by erosion uses an ion beam, it is only natural to take advantage of this erosion by analyzing these sputtered species. Figure 25 shows typical arrangements for complementary use of SIMS with ISS and AES. Even when the usual geometry cannot be used in an existing instrument, a little ingenuity in design can provide good SIMS results such as in the design of Figure 26. An area in which SIMS proves very valuable is to differentiate between nearby elements in which sufficient resolution is not obtained in the accompanying technique. Such an example was reported where the ion scattering spectrum of a foil lining screw cap showed only an unresolved peak which could have been either indium or tin. SIMS data on the other hand, showed unmistakably that a mixture of the two elements were present in the foil liner. Still another extremely useful area is a similar example as shown in Figure 27 where the titanium alloy Ti6Al4V has been treated with a commercial phosphate fluoride treatment and gives the ion scattering spectrum to the right of the figure. It can be seen that the surface is contaminated but it is not obvious whether the contaminated peak is calcium or potassium. The SIMS data to the left of the ISS spectra shows that primarily calcium is present on the surface and is responsible for the shoulder on the side of the titanium peak. Note also the vanadium at atomic mass No. 51 and the inability of ISS to differentiate between titanium and vanadium.
Figure 25. Complementary Use of SIMS with AES & ISS
Figure 26. A Unique Design to Allow Simultaneous AES & SIMS
Figure 27. ISS/SIMS Data for Ti6Al4V Alloy Treated by the Phosphate Fluoride Method
The extremely high sensitivity for low atomic number elements such as beryllium was taken advantage of in the solidification behavior of a Be$_{40}$Ti$_{50}$Zr$_{10}$ glass. It was found in this study and illustrated in Figure 28 that an excess amount of beryllium was found on the surface of the as-cast material. The material was quenched rapidly on a copper plate and traces of copper on the alloy surface were found. Cluster spectra in the region of mass 25-30 also shows that the beryllium is probably in an oxidized state or exists as a hydroxide on the surface. Thus SIMS by inference gives somewhat more information than techniques giving only elemental characterization information. In addition to showing sensitivity for many low atomic number elements, the SIMS technique has high sensitivity for many high atomic number elements. An example of this is shown in Figure 29, where a small amount of lead (Pb) impurity is seen in uranium dioxide. This lead impurity was not observed or separated in any of the other elemental techniques.

Mass resolution of SIMS is clearly an aid to ISS when examining certain groups of elements having adjacent mass numbers which cannot be resolved by ISS. Figure 30 shows the ISS spectra of chemically cleaned aluminum and aluminum treated with a dilute sodium silicate solution. While the slight shift in the aluminum peak position suggests silicon, it is insufficient except for very questionable qualitative analysis. Figure 30 shows the SIMS spectra of the same samples. The ratio of silicon to aluminum in the outer layers of the silicate treated aluminum appears to be about three to one. Depth profile analyses showed the thickness of the silicate coating to be only a few monolayers.

Baun (Reference 32) showed a very similar example in a study of adhesive bonding surfaces on aluminum alloys. Even "as received" materials show surprising surface composition as seen in Figure 31 where SIMS and ISS data on 2024 aluminum alloy (degreased) indicate high magnesium concentration at the surface. Conventional alkaline cleaning treatments do not etch the surface appreciably, leaving the surface magnesium rich. Such a surface when adhesively bonded may exhibit long time durability anomalies when compared with bonded structures in which formation of aluminum oxide has been ensured. The same author
Figure 28. ISS/SIMS Data for a Rapidly Solidified Be$_{40}$Ti$_{50}$Zr$_{10}$ Sample Quenched on Copper
Figure 29. +SIMS Data for UO₂ Sample Showing Pb Impurity
Figure 30. ISS/SIMS Data for Cleaned & Silicated Aluminum

Figure 31. ISS & +SIMS Data from 2024 Aluminum Alloy.
No Treatment Except for Degreasing
(Reference 33) also showed that ion scattering spectrometry and secondary ion mass spectrometry provide useful information on the locus of failure in an adhesive joint even when the film is only on the order of atomic dimensions or when the failure occurs near the original interface and includes parts of both the adhesive and adherend. SIMS was a near necessity in providing analysis of neighboring elements with the required sensitivity for adhesive bonding research.
SECTION VIII
APPLICATIONS

Many of the papers which appear in the literature concern primarily the technique of using SIMS; however, as the method becomes better developed more and more applications will appear. In the accompanying bibliography many illustrations are seen in which the technique is used either by itself or as a complementary method to another surface characterization tool. For instance, it is used for the study of thin films (2H), the surface chemistry of stainless steels (3A), silicon oxygen interaction (3F), surface oxidation studies on iron (5D), and of copper beryllium surfaces (9F). The index to the bibliography provides a comprehensive list of applications of SIMS.

Sparrow (Reference 34) has shown numerous applications of SIMS such as depicted in Figure 32, spectra from three aluminum castings prepared for painting. Sparrow shows that in many cases, particularly castings, metal surfaces are physically abraded prior to deposition of paints, polymers or laminates. These techniques serve two distinct purposes: 1) they remove the undesirable, thick surface oxides and contaminants, and 2) they produce a modified surface texture more desirable for the finished surface. The normal automatic mechanical techniques used occasionally do not remove contaminants sufficiently. Figure 32 illustrates SIMS spectra from three cast Al devices analyzed prior to paint coating. Specimen C indicates the original Al as received contains substantially high levels of Na, Mg, Si, and Ca. Sample B was sanded mechanically but still exhibits unusually high levels of Si. Both Al surfaces B and C resulted in paint coatings which exhibited early peeling and corrosion during normal exposure to humid environments. Manual sanding prior to paint coating resulted in removal of most Si as illustrated in A and yielded a product with an extended lifetime under similar environmental conditions. Sporadic and variable performance could also be correlated with the normal variations in surface concentrations of these contaminants on the original casting as received. Sparrow (Reference 35) has also developed a relationship used to calculate SIMS relative sensitivities which has been found to be extremely
valuable for general use in providing reliable quantitative approximations for most materials. Further, more accurate relationships can be used for each specific problem; however, this relationship is reasonably accurate, simple, and convenient for general applications.

Several applications of this technique to catalysts have been made. Figure 33 illustrates results for one of these applications. Small Al<sub>2</sub>O<sub>3</sub> beads approximately one millimeter in diameter homogeneously treated with Ni and Mo were analyzed to determine the cause of failures to rejuvenate spent catalyst. It is obvious that the spent catalyst is contaminated with Fe and low in Ni.

DiBenedetto and Scola (Reference 36) have used both ISS and SIMS to characterize surfaces of treated glass fibers and fiber/polymer interfaces. The results show how SIMS can be used to study the chemistry at the surface and chemical changes on the surface and at interfaces. By working at low power levels with insulator surfaces, the SIMS analysis showed changes in the structure of a polymerized silane coating as a function of depth of penetration into the interface. The concentration of nitrogen and hydrogen generated from the surface maintained a relatively constant level as the distance from the air-silane interface increased; then within 160Å into the surface, a dramatic increase in the
nitrogen level was noted, to a depth of 240Å. In this region, the simplicity of the SIMS spectra, with major peaks corresponding to the atomic constituents of \( \gamma \)-aminopropyltriethoxysilane, namely, H, C, N, O, and Si, suggested that low-molecular-weight oligomer was present in this region. This means that the silane coating was not sufficiently cured to provide a mechanically stable interface. Finally, from 240Å to the silane-glass interface, the nitrogen and hydrogen generated from the surface reached a lower constant level but about three times higher than that generated from the air-silane domain. This suggests that the silane polymer coating adjacent to the glass interface is different from the silane polymer at the air interface. Thus, it is clear that the ISS/SIMS technique can be used to define the interface and interphase regions and also to follow changes at the interface due to a chemical reaction.
SECTION IX

SOURCES OF INFORMATION ON SIMS

SIMS is similar to many areas of research in that there is no one place in which much of the data is published. There is a relatively large bank of data, but it is scattered among many journals and periodicals. There are, of course, various abstracting services such as Chemical Abstracts, Physical Abstracts, and Science Abstracts. There are numerous reports and patent search services, both private and in the government sector. Several services may be subscribed to and include Current Contents (Institute for Scientific Information, Philadelphia, Pa) which reproduces the contents of current journals and other services such as Index to Scientific and Technical Proceedings. The Chemical Abstracts Service (POB 3012, Columbus, Ohio) also offers numerous services including the very useful "CA Selects," produced every two weeks by a computer search of Chemical Abstracts. "CA Selects" is based on a concept pioneered by United Kingdom Chemical Information Service. Several "CA Selects" topics are of interest to the surface analyst. A sample page from the title, Surface Chemistry (Physiochemical Aspects) is shown in Figure 34. The Mass Spectrometry Bulletin published monthly in the United Kingdom has, in Section 6, "Surface Phenomena and Solid State Studies." A sample column is shown in Figure 35 from Section 6.

Early SIMS bibliographic material to 1972 was published by Balzers Corporation and the 3M Company maintained a SIMS bibliography of more modern work. There have been numerous SIMS reviews as seen in the attached bibliography.

Appendix C is the compilation of early literature by Balzers. Appendix D is a computer search of recent (1972 - present) SIMS references.
88: 181773q A comparison of a theoretical model and sensitivity factor calculations for quantification of SIMS data. Smith, David H.; Christie, W. H. (Anal. Chem. Div., Oak Ridge Natl. Lab. (ORNL), Oak Ridge, Tenn.) J. Mass Spectrom. Ion Phys. 1978, 26(1), 61-76 (Eng). The theor. local thermal equil. model of C. Andersen and J. Huntborne (1973) and the empirical method based on using av. relative sensitivity factors for detg. surface element concns. by secondary-ion mass spectroscopy were compared by using ~1000 data points obtained from 13 glass and 5 Fe samples. The results showed that, if a suitable set of sensitivity factors can be obtained, more accurate results were obtained through their use. Exptl. results were within a factor of 2 of the expected values 85% of the time when the sensitivity factor method was used, but were within that factor only 55% of the time when the theor. model was used. The advantages and disadvantages and expl. considerations for each method were discussed in detail.

88: 181857v The determination of adsorbed sodium, potassium, magnesium, and calcium on sediments containing calcium carbonate and magnesium carbonate. Neal, Colin (Inst. Hydrolog., Wallingford, Engl.) Clays Clay Miner. 1977, 25(4), 253-8 (Eng.). A method is described for the detn. of Na, K, Mg, and Ca cations adsorbed on clay minerals mixed with CaCO₃ and MgCO₃. The exchangeable cations are displaced by using an ethanolic LiCl-CsCl soln. Blank detn. using either a second ethanolic leach or a second LCl-CsCl leach are used to correct for carbonate dissolution. The method was tested by using mixts. of homoeoic forms of smectite and kaolinite with either CaCO₃ or MgCO₃. The smectite and kaolinite had total cation exchange capacities of ~765 and 39.6 mequiv/kg resp. and the amts. of cation exchanged varied directly with the proportion of clay mineral in the mixt. Tests with smectite-CaCO₃ mixts. in sea waters of various salinity vindicated the use of the method with heteroeioic forms of smectite and suggested that the fixation effect reported in other studies of clay minerals in estuarine conditions may be an artifact.

88: 181915n Spark mass spectrometric method for analysis of this films and the surface layers of solids. Liebig, V.; Mai, H. (Cent. Inst. Hard Subst. Mater., Dresden, E. Ger.) Prog. Pol. J. U.S.R. (Eng.). J. Phys. Chem. Solids 1977, 38(3), 379-84 (Eng.). The determination of adsorbed sodium, potassium, magnesium, and calcium on sediments containing calcium carbonate and magnesium carbonate. Neal, Colin (Inst. Hydrolog., Wallingford, Engl.) Clays Clay Miner. 1977, 25(4), 253-8 (Eng.). A method is described for the detn. of Na, K, Mg, and Ca cations adsorbed on clay minerals mixed with CaCO₃ and MgCO₃. The exchangeable cations are displaced by using an ethanolic LiCl-CsCl soln. Blank detn. using either a second ethanolic leach or a second LCl-CsCl leach are used to correct for carbonate dissolution. The method was tested by using mixts. of homoeoic forms of smectite and kaolinite with either CaCO₃ or MgCO₃. The smectite and kaolinite had total cation exchange capacities of ~765 and 39.6 mequiv/kg resp. and the amts. of cation exchanged varied directly with the proportion of clay mineral in the mixt. Tests with smectite-CaCO₃ mixts. in sea waters of various salinity vindicated the use of the method with heteroeioic forms of smectite and suggested that the fixation effect reported in other studies of clay minerals in estuarine conditions may be an artifact.
SECTION 6
SURFACE PHENOMENA AND
SOLID STATE STUDIES

548 Sputtering of Fe(iii) crystal under Ar(+) and Kr(+) ion bombardment
Bhattacharya R.S., Basu D., Karmohapatro S.B.
Indian J. Phys. V.48 N.10 P.941-3 1975
Ion impact, Single crystal, Sputtering, Surface, Ar, Kr

549 Ion penetration
Brown F.
PR-CMa-32 AECL-5122 Atomic Energy of Canada Ltd., Chalk River Nuclear
Labs, Ontario, Canada Sect.1-2 P.8-21 1975
Channelling, Cross section, Ion impact, Ion implantation, Ionization, Range,
Scattering, Single crystal, Surface, Al, Si, Cu, Ge, Kr, Pt, Silicon

550 Study of the Systems silicon-alumina and silicon-silica-alumina
by mass spectrometry of secondary ions (Russian)
Didenko P.I., Litochenko V.G., Marchenko R.I., Romanova G.F.
Scattering, Scattering-ions, Secondary emission, Secondary ion emission,
Sputtering, Surface, Temperature effects, Al, Si, Al02(+), Al10(+),
Semiconductors, Si0(+), Silicon-alumina system

551 Photoemission of positive ions in the reaction of nitrogen with
hydrogen on platinum
Zav'yalov S.A., Gutman E.E., Myasnikov I.A.
V.49 N.I. P.237-8 1975
Adsorption, Chemical reactions, Free radicals, Ions, Photon impact,
Secondary emission, Secondary ion emission, Surface, Temperature effects,
H, Hydrazine, Platinum

552 Diatomic versus atomic secondary ion emission
Wittmaack K., Staudenmaier G.
Ion impact, Microprobe, Molecular ions, Quadrupole, Secondary emission.
Secondary ion emission, Sputtering Surface, Yield, Al Si, Ar, Ti, V, Cr,
Ne, Mo, Ta, W, Au, Niobium, Silicon Tantalum

553 Redeposition of sputtered species during ion etching of Cu, Ag,
and Au
Miller A.C., Czanderna A.W.
J. Vacuum Sci. Technol. V.12 N.5 P.1086-7 1973
Ion impact, Scattering, Scattering-ions, Sputtering, Surface Ne, Cu, Ag,
Au, Copper foil, Gold foil, ISS, Silver foil

Figure 35. Sample of a Column from Section 6 of the Mass Spectrometry
Bulletin (United Kingdom)
554  Bombardment of field-emission cathodes by positive ions formed in the interelectrode region
Brodie I.
Int. J. Electron, V.38 N.4 P.541-50 1975
Electrons, Field ionization, Ion impact, Ionization, Source, Sputtering.

555  Secondary-electron emission in the backward and forward directions from thin carbon foils traversed by 25-250 KeV proton beams
Meckbach W., Braunstein G., Arista N.
Electrons, Energy distribution, Ion impact, Retarding potential measurements
Secondary emission, Secondary electron emission, Surface, Carbon foil

556  Experiments on compound analysis by secondary ion mass spectrometry (German)
Dittmann J.
Mikrochim, Acta, Suppl.6 P.359-71 1975
Chemical binding energy, Excitation, Fragmentation mechanism, Ion impact, Ions, Kinetics of ion formation, Low resolving power data, Molecular ions, Negative ions, Secondary emission, Secondary ion emission, SIMS, Steel, MOZ

557  Average energy of sputtered ions from fifteen polycrystalline targets
Jurela Z.
Energy distribution, Ions, Kinetic energy, Negative ions, Sputtering, Theoretical, Yield, C, Mg, Al, Si, Mn, Co, Ni, Cu, Ge, Me, Ag, Ta, W, Pt, Au

558  A quantitative model for the interpretation of secondary ion mass spectra of dilute alloys
Gries W.H., Rudenauer F.G.
Chemical binding energy, Energy distribution, Ion impact, Ions, Secondary emission, Secondary ion emission, Sputtering, Surface Theoretical, Yield, Mg, Al, Si, Ar, Ti, Cu, Alloys, Aluminum, Copper, SIMS

559  Secondary ion mass spectrometry
Evans C.A.
9th Great Lakes Regional ACS Mtg., College of St. Thomas, St. Paul, Minn., USA 4-6 June 1975 Abstr. N.62
Conference, Ion impact, Microprobe, Secondary emission, Secondary ion emission, Sputtering, Surface, SIMS, St. Paul

560  Surface analysis by ion scattering and secondary ion mass spectroscopy
Gen R.F.
9th Great Lakes Regional ACS Mtg. College of St. Thomas, Ts. Paul, Minn., USA 4-6 June 1975 Abstr. N.63
Conference, Detection limit, Ion energy loss spectra, low impact, Ions, Negative Ions, Scattering, Scattering-ions, Secondary emission, Secondary ion emission, Sensitivity, Sputtering, Surface, ISS SIMS, St. Paul

Figure 35. Concluded.
REFERENCES

REFERENCES (CONCLUDED)


APPENDIX A

STABLE, NATURALLY OCCURRING

ISOTOPES AND THEIR ABUNDANCES

*Compiled by 3M Co., St. Paul, MN
## Relative Abundances of Naturally Occurring Isotopes

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**Notes:**
- 84 (Po), 85 (At), 86 (Rn), 87 (Fr), 88 (Ra), 89 (Ac), DO NOT OCCUR NATURALLY
- 92 (Np), 94 (Pu), 95 (Am), 96 (Cm), 97 (Bk), 98 (Cf), 99 (Es), 100 (Fm), 101 (Md), 102 (No), 103 (Lw), DO NOT OCCUR NATURALLY
APPENDIX B

SOURCES OF INFORMATION ON SIMS AND
OTHER SURFACE CHARACTERIZATION METHODS
I. ABSTRACTING AND CURRENT AWARENESS PUBLICATIONS

A. AMERICAN CHEMICAL SOCIETY
   1155 Sixteenth St. N.W.
   Washington D.C. 20036

a.) ACS PUBLICATIONS
   i.) ACS Single Article Service
       Biweekly. It consists of the table of contents of 18 ACS journals:

   ii.) Chemical Titles (CT)
       Biweekly. CT is a current-awareness publication which reports the titles of recently published papers of chemical interest. CT is designed to alert chemists and chemical engineers to current information appearing in approximately 700 of the world's most important chemical journals. Each issue contains a keyword index.

   iii.) CA Selects
       Biweekly. A CA Selects is published for 36 different subject areas, document coverage is the same as for Chemical Abstracts. Each issue contains abstracts on that subject.

b.) CHEMICAL ABSTRACTS SERVICE DIVISION
   P.O. Box 3012
   Columbus, Ohio 43210

   i.) Chemical Abstracts (CA)
       Weekly. CA contains bibliographic citations for and abstracts of documents whose contents is related to chemistry and chemical engineering. Weekly issues contain indexes. Abstracts are grouped into 80 sections. Some 14,000 different scientific journals from more than 150 countries and in more than 50 languages are monitored regularly as are patents from 26 countries, conference proceedings and dissertations.
B. INSTITUTE FOR SCIENTIFIC INFORMATION (ISI)
325 Chestnut Street
Philadelphia, Pennsylvania 19106

i.) Current Contents
Weekly. It consists of reproduction of the table of contents of the most important journals in science. Six different topics are published including:

- Physical and Chemical Sciences
- Engineering, Technology and Applied Sciences

ii.) ASCA (Automatic Subject Citation Alert)
Individualised current awareness program. The researcher is the only subscriber to the profile (based on key words, authors etc.). It covers the most recent issues of 5,200 journals. Does not include abstracts.

iii.) ASCA Topics
Weekly. Current awareness program covering over 460 predetermined areas. Format is the same as ASCA.

U.S. GOVERNMENT
National Technical Information Service
5285 Port Royal Road
Springfield, Virginia 22161

i.) Government Reports Announcements
Biweekly. It contains abstracts of government research reports.

ii.) ERDA data bases
Many of the data bases used at the Lawrence Livermore Laboratory for determining physical and spectral properties are available through NTIS (National Technical Information Service). These include:

- Spectroscopic Constants for Selected Heteronuclear Diatomic Molecules
- Atomic Energy Levels and Transition data for the First and Second Ionisation States of the Elements Hydrogen through Phosphorous
MISCELLANEOUS

i.) CIS (Chemical Information System)

This system which consists of eight components was developed
by NIH, EPA and NBS. It is now available to the public
through Fein-Marquat Associates (7215 York Road, Baltimore,
Maryland 21212). The components are as follows:

The Mass Spectra Search System (MSSS)
The X ray Crystallographic Search System (CRYST)
The Carbon-13 NMR Search System (CNMR)
The Structure and Nomenclature Search System
(SANSS - formerly SSS)
The Powder Diffraction Analysis System (PDAS
--to be available later this year)
The Registry of Toxic Effects of Chemical Substances (RTECS)
The On-line Modeling Laboratory (MLAB)
The Conformational Analysis of Molecules in Solution by
Empirical and Quantum-mechanical Techniques
System (CAMSEQ)

Selected Research in Microfiche (SRIM)

Biweekly. For each subject area chosen (there are about
500 available) full texts of research reports on microfiche
which pertain to that subject area are sent to the subscriber.
APPENDIX C
EARLY LITERATURE 1963 - 1972
(FROM BALZERS LITERATURE SERVICE
SIMS DEC. 1973)
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<th>Untersuchung über die Emission positiver Sekundärionen und die Reflexion von Ed-Inversionen an Festkörperoberflächen.</th>
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<td></td>
<td>V. Walther, H. Hintenberger (MPI, Mainz, Dl).</td>
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<tr>
<td></td>
<td>Elektronenstoßquelle, Parabelspie,e, C, Al, Fe, Cu, Ag, T, W, Pt, Au, 2 Hg-Diff., P, 3 Cd-Diff., P, ausbesen der</td>
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<td>SI als Fkt. von PI-Energie, PI-Masse, Beschusszeit und Temperatur, Energieverlust der SI und reflekt. PI.</td>
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<th>Secondary Positive Ion Emission from a Tantalum Surface</th>
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<td>J. A. McHugh, J. C. Sheffield (General Electric Company, Schenectady, N.Y., USA).</td>
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<td>Ta, 180 mgl. Abhäng., SI-Ausbeute als Fkt. von Pl-Masse</td>
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<td>und PI-Energie, Reflexionskoeff. der PI.</td>
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<td>Doppelschichtquelle, Oddiff, P mit N2-Kühlfalle,</td>
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<td>Z. Naturforsch. (D), 19a, 1627 - 1629 (1964)</td>
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68 - 5 Mass Analysis of Ions Produced by Hypervelocity Impact.

D.O. Hanson
(TRW, Redondo Beach, Calif., USA).


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| A. Benninghoven |
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| A. Benninghoven |
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Z. Jurela
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69 - 13 Secondary Emission of Mo⁺ Ions during Bombardment of Molybdenum by Alkali-Metal Ions.
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P. Joyes
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kinetische Emission der SI, Ionisierung der Teile, Lebensdauer der virtuellen Ionisierung.

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P. Joyes
(CNRS, Orsay, Fl).


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**H. Nishimura, J. Okano**  
(Univ. Osaka, Jl.)


### 70 - 1 Application de l'émission ionique secondaire a l'analyse des couches superficielles.

**R. Hernandez, P. Lanusse, G. Sindtian.**  

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### 69 - 19 Electron and Ion Microprobe Analysis.

**F. Heinrich**  


Elektronen- und Ionenmikrosonde, Review.

### 70 - 2 Einfluss der Oberflächenzusammensetzung auf die durch Aufspaltung einer Ionenbindung verursachte Sekundärionenemission von Festkörpern.

**A. Benninghoven**  
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Si durch Stoßionisation, Rücktransport.


**J. C. Robb, D. R. Terrell, D. W. Thomas**  
(Univ., Birmingham, GB).


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### 70 - 3 Die Analyse monomolekularer Festkorperoberflächen schichten mit Hilfe der Sekundärionenemission.

**A Benninghoven**  
(Univ. Kiel).


statisch, Monolage, Ag, Mo.

### 69 - 21 Application of the Ion Microprobe Mass Analyser.

**C. A. Andersen, H. J. Roden, C. F. Robin son**  
(Haster, Getra, Calif., USA).


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### 70 - 4 Influence of Composition and Structure of Fe Co Alloys on Discharge of Positive Ions during Atomization by I onic Bombardment.

**M. A. Vasil’ev, Yu. N. Ivashchenko, V. T. Cherepin.**  

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<td>Zh. Tekh. Fiz. (SU), 40, 2469 - 2471 (1970), Russisch</td>
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**P. Joyes**


Spectrométrie, méthionomique Ions.

### 71 - 3 Emission ionique secondaire des Alliages Cuivre Aluminium en Présence d'Oxygène

**D. Brochard, G. Slodzian**

CNRS, Orsay, Fr.

*J. Phys. (F), 32, 185 - 190 (1971)*

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**C.A. Evans jr.**

Int. Conf. Mass Sp., Brussel (8), 1970

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**G. Blaise, G. Slodzian**

CNRS, Orsay, Fr.

*C.R. Hebd. Acad. Sci. (F), 273, 357 - 360 (1971)*

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**A. Benninghoven, S. Storp.**

Univ. Köln


Dünne Schichten, UHV, AI auf Mo aufgetampft, oberfl. und innere Kontrolle und Oxidschichten.

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**A.B. Campbell, C.B. Cooper**

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**A.J. Socha**

(Bell Howard, Pasadena, Calif., USA)


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R.K. Lewis  
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V. I. Vekshin, B. A. Tsipinyuk


71 - 16 Effect of Oxygen Pressure on the Initial Stage in the Oxidation of Molybdenum


Mo, (100), Oxidationsbeginn, 02-Partialdruck als Parameter der Oxidation.

71 - 20 Interaction of Ions and Electrons with Adsorbed Gases

R. Clampitt

ICL Lab., Abingdon, Engl., GBI.


EID, SIMS, Ads. und Desorption, Energievert.

71 - 17 Changes in the Characteristic Energy-Loss Spectrum of Molybdenum during Oxidation of the Molybdenum Surface


Energieverlustspektrum, 02-Partialdruck als Parameter der Oxidation.

71 - 21 A Combined Ion and Electron Microprobe

H. Lielb


Ionen- und Elektronenmikrosonde, doppelfok.

71 - 18 Ion Mass-Spectral Microscope

Yu. P. Maitet, V. T. Cherepin


71 - 22 Secondary Ion Emission from Solid Surfaces

R. Casteing, J. F. Hennequin


Augerwirk.
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<tr>
<th>Year</th>
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<td>quantitative Titration, B in Sr.</td>
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<td>IMMA, Review, Empfindlichkeit, Spurenanalyse</td>
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<td>Cu n + Ag n-, Partikel von n, Stabilität, Ionen, Pot., Elektronenanfangs</td>
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<td>71</td>
<td>Surface Analysis Using Simultaneous Electron and Ion Bombardment</td>
<td>C.R. Crawford</td>
<td>10th national meeting of the society for applied spectroscopy (Abstracts only), St. Louis, Mo. (USA), 18 - 22 Oct 1971 (New York, USA); Soc. Appl. Spectroscopy 1971, p. 70</td>
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<td>Elektronenanfangs- und IMMA in einem Gerät, Tiefenprofile</td>
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<td>Impulsübertrag langs Molekülschär, Emissionennergie</td>
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<td>Vergl. versch. SIMS- und IMMA Apparaturen</td>
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<td>71</td>
<td>The Ion Microprobe Mass Analyzer</td>
<td>J.B. Nicholson</td>
<td>10th national meeting of the society for applied spectroscopy (Abstracts only), St. Louis, Mo. (USA), 18 - 22 Oct 1971 (New York, USA); Soc. Appl. Spectroscopy 1971, p. 69 - 70,</td>
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<td>IMMA, Review</td>
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<td>Ionenmikroprobe, neg. SI</td>
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<td>71 - 31 Analysis of Thin Films by Ion Microprobe Mass Analyser.</td>
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<tr>
<td>H. Tamura, T. Kondo, H. Doi</td>
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<td>IMMA, dünne Schichten.</td>
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<tr>
<td>Ya. M. Fogel</td>
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<tr>
<td>(Gorki State Univ., Kharkov, USSR)</td>
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<td>Review</td>
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<tr>
<th>71 - 32 Application of Mass Spectrometry to the Analysis of Semiconductor Materials</th>
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<tbody>
<tr>
<td>G. C. Sweeney, E. Berkey</td>
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<tr>
<td>(Westinghouse, Pittsburgh, Pa., USA).</td>
</tr>
<tr>
<td>Vergleich von Massenspektrometern mit Si und Funktionselektrizität, Si, Ga, As. Dostierungs- und Verunreinigungsanalyse.</td>
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<tr>
<th>72 - 4 Analyssystem zur Sekundär-Ionen-Massenspektrometrie im Ultra-Hochvakuum</th>
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<tbody>
<tr>
<td>W. K. Huber, E. Lübach</td>
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<tr>
<td>(Batier, Liechtenstein)</td>
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<tr>
<td>Verhandl. DPG, 5, 470, 0 - 28 (1972)</td>
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<tr>
<td>Monolage, UHV, N2, Kuhl., Turbop., Ti-Subl.-P., Quad.</td>
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<tr>
<th>72 - 1 An Analytical System for Secondary Ion Mass Spectrometry in Ultra High Vacuum</th>
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<tr>
<td>W. K. Huber, H. Selhofer</td>
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<tr>
<td>(Batier, Liechtenstein)</td>
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<tr>
<td>A. Benninghoven</td>
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<tr>
<td>(Universität Köln)</td>
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<tr>
<td>J. Vac. Sci. Tech. (USA), 9, 482 - 486 (1972); Proc. of the 5th int. vac. congr. part I, Boston, Mass., USA (1971)</td>
</tr>
<tr>
<td>UHV Monolage, Profil, SIMS, EID, AES, Targenwechsler ter. BI. Quelle zur Einladung, Quiek., Turbop., N2 Kuhl., Ti-Subl.-P.</td>
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<th>72 - 5 Ein Sekundärionenmassenspektrometer hoher Nachweisempfindlichkeit mit elektrischem Quadruopol.</th>
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<tr>
<td>J. Maul, F. Schulz, K. Wittmaack</td>
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<tr>
<td>(GSF, Neuherberg)</td>
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<tr>
<td>Verhandl. DPG, 5, 444, S 21 (1972)</td>
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<tr>
<td>große Energiespannung, Quiek., Passivondamper gegen Untergrund. Dostierungsprobe von 8 in S-1bars ppb.</td>
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<th>72 - 2 Spectrographie de masse avec source à émission ionique secondaire</th>
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<tr>
<td>R. Hernandez, P. Lanusse, G. Slodzian, G. Vidal</td>
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<td>(IONERA, Chassiron, F1)</td>
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<tr>
<td>Recherche Aérop. 313 (1972)</td>
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<tr>
<td>Matranch Herstog doppelfok., Monolage, Profil, Ausbrute, Ionep., Ti-Subl.-P, Duplasamion, traktion. Beschuss</td>
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<tr>
<th>72 - 6 Probleme und Empfindlichkeitsgrenzen der Sekundärionenmassenspektrometrie</th>
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<tr>
<td>F. G. Rudenauer</td>
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<td>Verhandl. DPG, 5, 469, 0 - 27 (1972)</td>
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<tr>
<td>Parameter der Nachweisempfindlichkeit, Ionep., Enertrz, Analys, Akzeptanz, Phasenvorvermehrung, 0,001 sbb, magnet, Abgleg.</td>
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<tr>
<td>Z. Jurela (Boris Kidric Inst., Belgrad, YU).</td>
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<th>72 - 19</th>
<th>Possibilities of the Ion Microprobe in Surface Analysis</th>
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<tr>
<td>L. Habraken, V. Leroy, J.P. Servais (CRM, Liege, B).</td>
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<td>Ionenmikrosonde, Oberfl.-Analyse, dünne Schichten, Beschusskanale, Mikroanalyse, Tiefenprofile überzogener Stähle.</td>
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<tr>
<th>72 - 16</th>
<th>Comparison of Secondary Ion Yields from Conducting, Semiconducting, and Nonconducting Targets Bombarded with 40 keV Argon Ions</th>
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<td>Z. Jurela (Boris Kidric Inst., Belgrad, YU).</td>
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<th>72 - 17</th>
<th>Theory of the Ionization Probability for an Atom Crossing a Metal-Vacuum Surface</th>
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<tr>
<td>P. Joyes, G. Toulouse (CNRS, Orsay, F).</td>
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<td>Ionisierungswahrschein., Emission von Metallatom aus Metallmatrix.</td>
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<th>72 - 20</th>
<th>A New Analytical Technique for Insulating Materials by Means of an Ion Microanalyser</th>
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<tr>
<td>K. Nakamura, S. Aoki, Y. Nakajima (Hitachi Ltd., Ibaraki-ken, J).</td>
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<td>Isolatoren, Elektronenbeschuss gegen Auflistung.</td>
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<th>72 - 18</th>
<th>Influence of Asymmetrical Correlations in the Secondary Emission of Solid Compounds</th>
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<tr>
<td>P. Joyes (CNRS, Orsay, F).</td>
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<tr>
<td>kinetische Emission, 2-Komponenten-Targets, (Al, O), (Al, Cu).</td>
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<th>72 - 21</th>
<th>Ionenmikrosondenanalysatoren</th>
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<tr>
<td>H. Liebi (Euratom-Association, Garching, D).</td>
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<tr>
<td>Messtechnik (D). 80, 358 - 365 (1972)</td>
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<td>Ionenmikroskopen, Review</td>
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<th>72 - 22</th>
<th>Ion Microprobe Mass Analyser</th>
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<tr>
<td>C.A. Andersen, J.R. Hinthorne (Haster, Goleta, Calif., USA).</td>
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<td>Science (USA). 175, 853 - 860 (1972)</td>
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<tr>
<td>Review, IMA von Liebi.</td>
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APPENDIX D

RECENT LITERATURE - SIMS COMPUTER SEARCH OF
CHEMICAL ABSTRACTS 1972 THROUGH 18 MAY 1978
LOCKHEED SYSTEM

Index identifies referenced by page number and
alphabetical letter serially assigned to each reference.
Literature Index to Appendix D

Adsorption - 15H, 33B, 46D, 50B, 58B, 62A


Charging - 17G, 43D


Ion Implantation Phenomena - 3E, 5F, 6C, 15E, 46A, 49B, 50E, 55D, 60E


Magnetic Mass Spectrometer - 2D, 4G


Insulators - 17G, 21F, 39B, 43D, 45B, 51A, 66C

Isotopes - 9B, 15G, 17D, 26F, 58C, 59B

Negative Ion - 1B, 31C, 47B

Molecular (Cluster) Ions - 20B, 31D, 36B, 68B

Patents - 3C, 8E, 17B, 17C, 18B, 45C

SIMS used with other techniques (such as ISS, AES) - 1A, 2B, 4C, 4D, 4E, 5C, 5E, 6B, 6D, 7F, 8D, 8H, 9C, 9F, 10E, 11C, 11E,

**Organic Compounds** - 1D, 1E, 7C, 22B, 23F, 26E, 37B, 49D, 62C, 68B


**Surface Reactions** - 1C, 7E, 27A, 28B

**Static SIMS (SSIMS)** - 1C, 2A, 2C, 2G, 5D, 17E, 33B

**Steel** - 27D, 33D, 68A

**Stainless Steel** - 3A, 8D, 11B, 19F, 33D, 57A

**Positive Ions** - 1D, 1E, 15F, 29D, 29E, 36C, 40C

**Temperature Effects** - 8G, 10A, 48A, 55D


Compounds - (Ga As) 3D, (Ga As) 8F, (Mica) 14A, (Ga As) 25A, (Ti N) 27B, (Mica) 28E, (Fe Oxide) 35E, (G a N) 38B, (InP) 40D, (Ga As) 49B, (Ga As) 50E, (Ga As) 51C, (Feldspar) 52B, (Ga As) 61A, (Ga As) 61E, (III-V) 62D, (Apatite) 66A

Elements - (W) - 1A, 4C, 6A, 9A, 30E, 54D (Au) - 5C, 10E

(Fe) 5D, 26A (Pt) - 6D, 42A, 46E (Ta) - 10B (Cu) - 15F
(Al) - 20E, 24A, 25B, 50A (I) - 25F, (V) - 32E, (H) - 34E,
(Ti) - 37A, 38A, (Cr) - 41C (B) - 46A, (Sc) - 49B,
(Ni) - 50B, (Mb) - 50C, 58B, (U) - 52C (Rare Earths) 61B,
(Cu) 61C, (Al) 64C, (H) 65C, (Al) 66B

Alloys - (Cu/Be) 9F, (Cu/Ni) (Cu/Al) 20D, (7050 & 6061 Al) 21C,
(Cu Ni & Cu Al) 31D, (Fe AlO) 33A, (Pt Rh) 33D, (Ni Cr Fe) 34D, (Cu Ni) (Ni Fe) (Fe Al) (Cu Al) 40A, (Fe Ni) 67C,
(Fe Cr) 67C, (Fe Ni) 67D, (Fe Cr) 67D
CA0781400800802
Investigation of surface layers by SIMS (secondary ion mass spectroscopy) and SIMS (secondary ion imaging mass spectrometry)

Author: Werner, H. W., De Greffe, H. A. M.
Section: CA066003 Publ Class: J
Series: 35 Issue: 2 Pages: 427-57
Identifiers: surface secondary ion mass spectroscopy, surface secondary ion collection, ion microprobe analyzer, mass spectrometer ion collection

CA0781400800802
Analysis of monomolecular layers of solids by the static method of secondary ion mass spectroscopy (SIMS)

Author: Benninghoven, A., Loebach, E.
Section: CA071011, CA079000 Publ Class: J
Journal: J. Radioanal. Chem. Coden: URACBH Publ: 72
Series: 12 Issue: 1 Pages: 95-9
Identifiers: secondary ion mass spectrometry, surface monolayer mass spectroscopy

CA0781400800802
Comparison between quadrupole and magnetic mass spectrometers for use in SIM (secondary ion mass spectrometry)

Author: Rudenauer, F. G.
Location: Osterr. Studienges. Atomenergi. G.m.b.H., Vienna, Austria
Section: CA071011 Publ Class: I
Identifiers: mass spectrometer comparison, secondary ion mass spectrometry, magnetic mass spectrometer, quadrupole mass spectrometer

CA07806035212
Secondary-ion collection system for an ion microprobe analyzer of high-mass resolution

Author: Kronn, V. E., Hingo, G. R.
Location: Argonne Natl. Lab., Argonne, Ill.
Section: CA071011 Publ Class: J
Series: 43 Issue: 12 Pages: 1771-2
Identifiers: secondary ion collection, ion microprobe analyzer, mass spectrometer ion collection

CA0771400043917
Mass spectrometer for analysis of solids bodies

Location: Inst. Metallofiz., Kiev, USSR
Section: CA071011, CA079000 Publ Class: J
Issue: 3 Pages: 159-60 Language: Russ
Identifiers: mass spectrometer analysis solid, secondary ion mass spectrometer analysis solid, elemental analysis solid, layer analysis solid

CA0771400043917
Analysis of solid surfaces and thin films by the statistical method of secondary ion mass spectrometry

Author: Benninghoven, Alfred
Section: CA071011, CA079000 Publ Class: C
Publisher: Wiss. Verlagsges. Address: Stuttgart, Ger
Available: Auflender, Max
Identifiers: secondary ion mass spectroscopy, solid surface analysis
A REVIEW AND BIBLIOGRAPHY OF SECONDARY ION MASS SPECTROMETRY (S-ETC(U))

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CA0798080468902E

Ionic mass-spectral microscope (secondary-ion mass spectrometer)
Author: Maihet, Yu. P., Filipenko, A. P., Cherepin, V. T.
Location: Inst. Metallofiz., Kiev, USSR
Section: CA079111. CA079000 Publ Class: J
Identifiers: secondary ion mass spectrometer, conch, mass spectrometer

CA0798080468907G

Instrumental aspects of secondary ion mass spectrometry and secondary ion imaging mass spectrometry
Author: Werner, H. W.
Location: Philips Fbr. Lab., Eindhoven, Neth.
Section: CA079111 Publ Class: J
Journal: Vacuum Coden: VACAV Publ: 72 Series: 22 Issue: 11 Pages: 613-17
Identifiers: secondary ion mass spectrometry, titania oxide, iron mass spectrum, iron manganese ferrite spectrum

CA0798080468905E

Comparison between quadrupole and magnetic mass spectrometers for use in SIM (secondary ion mass spectrometry)
Author: Ruedenauer, F. G.
Location: Oester, Studenges. fur At. G.m.B.H., Vienna, Austria
Section: CA079111 Publ Class: J
Journal: Vacuum Coden: VACAV Publ: 72 Series: 22 Issue: 11 Pages: 609-12
Identifiers: mass spectrometer comparison, secondary ion mass spectrometry, graphite secondary mass spectrum, iodine 127, selenium matrix, selenium matrix iodine 127, aluminum magnesium energy distribution

CA10002000851E

Aequativus Fundamentals and uses of the image-forming secondary-ion mass spectrometer
Author: Gauckler, N. H.
Section: CA079111 Publ Class: T
Identifiers: secondary ion mass spectrometer
CA80012064617
Quantitative analysis of light elements (nitrogen, carbon, and oxygen) in sputtered tantalum films by Auger electron spectroscopy and secondary ion mass spectrometry (SIMS)
Author: Morimoto, J. M.
Section: CA079006 Publ Class: J
Identifiers: secondary ion mass spectrometry, tantalum film analysis, oxygen, nitrogen, carbon

CA800106032776
Source with secondary ion emission for a mass spectrometer with double focusing
Author: Lototskii, A. G.
Location: State Sci-Res. Des. Inst. Rare Met. Ind., Moscow, USSR
Section: CA079002 Publ Class: J
Identifiers: ion source mass spectrometry, secondary ion emission mass spectrometer, copper analysis impurities mass spectrometry

CA800104018251
SIMS (secondary ion mass spectrometer) with a standard quadrupole residual gas analyzer
Author: Thomas, G. E., De Kuijzenaar, E. E.
Location: Philips Res. Lab., Eindhoven, Neth.
Section: CA071011 Publ Class: J
Identifiers: secondary ion mass spectrometry, quadrupole residual gas analyzer

CA820241408739
Composition profile of ion-plated gold film on copper analyzed by AES (Auger electron spectroscopy) and SIMS (secondary ion mass spectra) during xenon ion bombardment
Author: Narusawa, Tadashi, Komiya, Souji
Location: ULVAC Corp., Chigasaki, Japan
Section: CA079008, CA071000, CA078000 Publ Class: J
Identifiers: secondary ion mass spectrometry, surface analysis, gold film, AES, SIMS, composition profile, copper, xenon ion, bombardment

CA800105139047
Surface oxidation studies of iron using the static method of secondary ion mass spectrometry (SIMS)
Author: Stumpe, E., Benninghoven, A.
Section: CA071011, CA067000, CA086000 Publ Class: J
Identifiers: surface oxide iron, secondary ion mass spectrometry

CA80012064611
Physical effects and principal possibilities of application of secondary ion mass spectrometry SIMS
Author: Beske, H. E.
Section: CA071011 Publ Class: T
Identifiers: secondary ion mass spectrometry
Analysis of tungsten surfaces in an imaging mass spectrometer by means of secondary and thermionic ions
Author: Prager, W., Gaukler, R. M.
Section: C4 60 0 0
Identifiers: tungsten ion emission, secondary ion emission tungsten, thermionic ion emission tungsten, surface tungsten ion emission

Surface investigation by ion scattering and secondary ion mass spectroscopy
Author: Halland, M.
Location: Max-Planck-Instit. Plasmaphys., EURATOM, Garching, Ger.
Section: C4 60 0 0
Identifiers: review surface scattering spectroscopy, scattering ion surface review, mass spectroscopy surface review

Mechanism of simultaneous implantation and sputtering by high energy oxygen ions during secondary ion mass spectrometry (SIMS) analysis
Author: Tsai, J. C. C., Morabito, J. M.
Location: Bell Teleph. Lab., Reading, Pa.
Section: C4 60 0 0
Identifiers: secondary ion mass spectrometry, implantation sputtering mass spectrometry, oxygen bombardment mass spectrometry

Composition profiles of CVD (chemical vapor deposition) platinum and platinum silicide by Auger electron spectroscopy and secondary ion mass spectrometry
Author: Morabito, J. M., Rand, M. J.
Section: C4 60 0 0
Identifiers: platinum thin film analysis, Auger electron spectroscopy film analysis, mass spectrometry film analysis,

phosphorus, oxygen, platinum film, oxygen, platinum film, silicon, oxygen, platinum film, film analysis impurity, silicide, platinum analysis

Qualitative and quantitative analysis in secondary-ion mass spectroscopy
Author: Rüdenauer, F. G., Steiger, W., Pontenschlag, W.
Location: Physikinst. Reaktorzent. Seibersdorf, Oesterreich
Identifiers: review secondary ion mass spectrometry

Investigation of the nickel–dinitrogen oxide system by secondary ion mass spectrometry
Author: Banger, M., W. Vickerman, J. C.
Section: C4 60 0 0
Identifiers: nitrogen oxide reaction nickel, mass spectrum nickel oxide, nitrogen oxide, adsorption nitrogen oxide nickel

Material analyses with a new high flux secondary mass spectrometer
Author: Pichmayr, F.
Location: Forschungszent. Seibersdorf, Oesterreich, Studienges.
Identifiers: mass spectrometer secondary ion, aluminum analysis, cesium, silicon carbide, silicon carbide analysis cesium
CA082145302X
Comparison between Auger electron spectroscopy (AES) and secondary ion mass spectrometry (SIMS) on well characterized single crystal surfaces
Author: Niem, R., Bauer, E. G.
Section: CA079005 Publ Class: J
Identifiers: Auger spectroscopy crystal surface analysis, electron spectroscopy crystal surface analysis, mass spectroscopy crystal surface analysis, secondary ion mass spectroscopy, silver deposit tungsten crystal surface, copper deposit tungsten crystal surface, tungsten crystal surface analysis.

CA082143050Z
Analysis of materials with a new high current secondary ion mass spectrometer
Author: Pichlmayer, F.
Location: Oester. Studienges. Atonener. G.m.b.H., Vienna. Austria
Section: CA071011, CA076005 Publ Class: J
Identifiers: mass spectrometer secondary ion, conc profile. detn mass spectrometer, implantation profile. detn mass spectrometer, cesium implantation profile. detn mass spectrometer. silicon carbide.

CA08200505920
Secondary ion emission of solids studied on the mass spectrometer MI-1305
Author: Nogurov, Sh. A., Chupalskov, Ch. M., Guseinov, A. A.
Location: Inst. Fiz., Makhachkala, USSR
Section: CA076011 Publ Class: J
Identifiers: secondary ion mass spectrometry, plasma ion source mass spectrometer.

CA08200505900
SIMS (secondary ion mass spectrometry) spectra of organic compounds
Author: Karasek, F. W.
Section: CA086005, CA076000 Publ Class: J
Identifiers: secondary ion mass spectrometry org

CA08200402499X
Secondary ion emission of solids studied on the mass spectrometer MI-1305
Author: Nogurov, Sh. A., Chupalskov, Ch. M., Guseinov, A. A.
Location: Inst. Fiz., Makhachkala, USSR
Section: CA076011 Publ Class: J
Identifiers: secondary ion mass spectrometry, plasma ion source mass spectrometer.
CA08302004655J
SIMS (secondary ion mass spectrometric) analysis of doped tungsten
Author: Peeler, A., Sweeney, G. G., Castle, P. M.
Section: CA078604, CA085600, CA078500 Publ Class: J
Series: 6A Issue: 5 Pages: 991-6
Identifiers: mass spectrometry doped tungsten, potassium doped tungsten filament, aluminum doped tungsten filament, silicon doped tungsten filament, tungsten filament impurity analysis, impurity segregation tungsten recrystallization, lamp filament doped tungsten

CA08302002665J
Isotope effect of ion-electron emission
Author: Fahn, Udo
Section: CA078601, CA078700 Publ Class: J
Identifiers: mass spectrometer isotope effect, isotope effect secondary emission, electron multiplier mass discrimination, beryllium isotope mass discrimination, aluminum isotope mass discrimination, nickel isotope mass discrimination

CA08302004637Y
Simultaneous observations of partially oxidized surfaces by AES (Auger electron spectroscopy) and SIMS (secondary ion mass spectrometry) for aluminum, silicon, titanium, vanadium, and chromium
Author: Komiya, S., Harumasa, T., Satake, T.
Location: ULVAC Corp., Chigasaki, Japan
Section: CA056603, CA066600 Publ Class: J
Series: 12 Issue: 1 Pages: 361-5
Identifiers: surface oxidized metal spectroscopy, aluminum oxidized Auger spectroscopy, silicon oxidized Auger spectroscopy, titanium oxidized Auger spectroscopy, vanadium oxidized Auger spectroscopy, chromium oxidized Auger spectroscopy, oxygen oxidized Auger spectroscopy

CA082265175612W
Study of surface processes on copper-beryllium by combined secondary ion mass spectrometry and Auger electron spectroscopy
Author: Kuhl, R., Huber, G., Goebel, E.
Location: Balzers, A.-G., Hochvakuumtech. und Duenne Schichten, Balzers, Liechtenstein
Section: CA066603, CA066600 Publ Class: C
Publisher: E. J. Appl. Phys., Address: Tokyo, Japan
Author: Kuwajima, Hiroto; Tomiyuki, Tomiyuki
Identifiers: copper-beryllium surface process

CA082265176780V
Detection of cyanide complexes in deposited gold with SIMS (secondary ion mass spectrometry)
Author: Keil, A.
Location: Inovon-Stroebele K.-G., Birkenfeld, Ger.
Section: CA072006 Publ Class: J
Journal: Galvantechnik Coden: GVRAY Publ: 75 Series: 66 Issue: 1 Pages: 9-12 Language: Ger
Identifiers: gold electrodeposition carbon coating, cyanide complex gold electrodeposition
CA083121086772G
Secondary ion microanalysis. Crystalline and temperature effects
Author: Castrofa, R.
Location: Lab. Phys., Solidus, Univ. Paris-Sud, Orsay, Fr.
Section: CA076000, CA078000
Codens: TOSAD
Publication: Wiley Address: New York, N. Y
Availability: Siegel, Benjamin M.; Beaman, Donald R
Identifiers: mass spectrometry secondary review, review secondary ion microanalysis, analysis ion microprobe review, crystal effect microanalysis review, temp effect microanalysis review

CA08312108688Y
SINS (secondary ion mass spectrometry) studies of the influence of the surface layers on the hydrogen penetration of tantalum foils
Author: Zuecher, H.; Boes, N.
Section: CA066003
Publication: Z. Phys. Chem. (Frankfurt am Main)
Codens: ZOCFX
Publication: 74
Series: 83
Issue: 1-6
Pages: 65-78
Language: Ger
Identifiers: hydrogen penetration tantalum surface contamination, mass spectrometry tantalum surface contamination

CA08310088621
Analysis of conducting and insulating surfaces by means of secondary ion mass spectrometry (SIMS)
Author: De Paz, M.; Maccio, C.
Location: Ist. Sci. Fis., Univ. Genova, Genoa, Italy
Section: CA076000
Publication: Z. Naturforsch., A
Codens: ZAMA
Publication: 75
Series: 30a
Issue: 6-7
Pages: 631-4
Identifiers: mass spectrometry water contamination, copper surface water contamination, lithium fluoride water contamination, fluoride lithium water contamination, potassium tetryo water contamination, tetryo potassium water contamination

CA08312070065U
Oxygen ion source for the secondary ion mass spectrometer
Author: Hishiguma, Hiroshi; Ohno, Jun
Location: Coll. Gen. Educ., Osaka Univ., Toyonaka, Japan
Section: CA076000
Publication: 75
Series: 83
Issue: 1
Pages: 1-14

Identifiers: mass spectrometer oxygen ion source

CA08306049720H
Composition profiles of several contaminated and cleaned surfaces of gold thick films on copper plates by Auger electron and secondary ion mass spectroscopy
Author: Koriya, S.; Mizuno, M.; Harae, T.; Masuda, M.
Location: ULVAC Corp., Chigasaki, Japan
Section: CA076000
Publication: 74
Series: 83
Issue: 1-6
Pages: 35-71
Identifiers: mass spectrometry analysis, Auger spectroscopy surface analysis, secondary ion mass spectrometry analysis, fusion plasma clean gold
CA08314125549F
Surface Investigation of solids by secondary ion mass spectrometry (SIMS)
Author: Benninghooven, A.
Section: CA079000, CA079000 Publ Class: J
Journal: DECHEMA-Monogr. Coden: DMGAG Publ: 75 Series: 78
Issue: 1957-1948 Pages: 197-214
Identifiers: review secondary ion mass spectrometry, surface analysis mass spectrometry review, solid surface mass spectrometry review, metal monolayer oxidation review, sputter layer removal review

CA08314113944U
Analysis of 301 stainless steel by SIMS (secondary ion mass spectrometry)
Author: Shupert, Rudolf
Location: Bell Teleph. Lab., Inc., Columbus, Ohio
Section: CA099008 Publ Class: J
Issue: 1 Pages: 509-6
Identifiers: stainless steel surface analysis, mass spectrometry stainless surface

CA08303107743K
Elemental analysis with Auger electron spectroscopy and secondary ion mass spectrometry
Author: Moregolo, J. M.
Section: CA079000, CA079000 Publ Class: C
(See-ICEBD0) Coden: SIMA47 Publ: 74 Pages: 139-52
Publisher: Electrochem. Soc., Inc. Address: Princeton, N. J
Avail: Bakish, Robert
Identifiers: Auger electron spectroscopy mass spectrometry, electron spectroscopy mass spectrometry, mass spectrometry Auger spectroscopy, semiconductor analysis, tantalum film analysis, dopant, silicon analysis dopant

CA08312170763C
Results on a UHV (ultrahigh vacuum) -ion microprobe for surface and trace analysis
Author: Ruedenauer, F. G., Steiger, W.
Location: SGAE, Vienne, Austria
Section: CA079002, CA079000 Publ Class: C
Publisher: Jon. J. Appl. Phys. Address: Tokyo, Japan
Avail: Kadoghi, Hiroto; Toya, Tomyuki
Identifiers: secondary ion mass spectrometer, ion microprobe analyzer, high vacuum ion microprobe, surface analysis ion microprobe, trace analysis ion microprobe, corrosion product analysis microprobe, steel analysis ion microprobe

CA08312170670U
Combination of SIMS (secondary ion mass spectrometry) and AES (Auger electron spectroscopy) for the analysis of thin films
Author: Buhl, R., Huber, W. K. L., Loebach, E.
Location: Balzers Aktiens. Hochvakuumtech. Duenne Schichten, Balzers, Liechtenstein
Section: CA079001 Publ Class: C
Publisher: Jon. J. Appl. Phys. Address: Tokyo, Japan
Avail: Kumagai, Hiroto; Toya, Tomyuki
Identifiers: secondary ion mass spectrometry, mass spectrometry Auger spectroscopy, electron Auger spectroscopy mass spectrometry, chromium layer analysis, iron chromium layer analysis, film analysis chromium iron, sputtering Auger spectroscopy mass spectrometry, aluminum substrate chromium film analysis

CA08312170326C
SIMS (secondary ion mass spectrometry) study of metals in function of the primary ion density
Author: Riedel, Nikolaus, Petrovic, Brana
Section: CA079001 Publ Class: J
Language: Hung
Identifiers: metal secondary ion yield, mass spectrometry secondary ion
CA83320171546A
Modification of existing apparatus for SIMS (secondary ion mass spectroscopy) in UHV (ultrahigh vacuum)
Author: Dowsett, W. G.; King, R. M.; Parker, E. H. C.
Section: CA078011 Publ Class: J
Identifiers: mass spectrometry argon gun, quadrupole residue analyzer mass spectrometry

CA83320171472Y
Diatomic versus atomic secondary ion emission
Author: Wittmack, R.; Staudenmair, G.
Section: CA076005 Publ Class: J
Identifiers: mass spectrometry secondary ion emission, metal secondary ion emission, semiconductor secondary ion emission

CA83318157230W
Elemental analysis with Auger electron spectroscopy and secondary ion mass spectrometry
Author: Morabito, J. M.
Section: CA076005 Publ Class: J
Publisher: NTIS Address: Springfield, Va
Identifiers: review Auger electron spectroscopy mass spectrometry, Auger electron spectroscopy review, secondary ion mass spectrometry review, surface analysis review, depth profile analysis review

CA833181566637N
Observation of solid surface by secondary ion mass spectrometry
Author: Harusawa, Tadashi; Satake, Toru; Konjiya, Souji
Location: Japan Vac. Eng. Co., Ltd., Chigasaki, Japan
Section: CA076011, CA066000 Publ Class: J
Identifiers: surface secondary ion mass spectrometry, metal surface mass spectrometry
CA08414089398T
Study of the mass spectrum of secondary ion--ion emission from the surface of micas on an MI-1305 mass spectrometer
Author: Magomedov, Sh. A., Chupalev, Ch. M., Guseinov, A. A.
Location: Dagestan. Filial, Inst. Fiz., Makhachkala, USSR
Publisher: "Naukova Dumka" Address: Kiev, USSR
Abstract: mass spectrum micas

CA08414089397S
Use of secondary ion emission for studying the structure of laminated dielectric semiconductor systems
Author: Litovchenko, V. G., Marchenko, R. I., Romanova, G. F.
Location: Inst. Poluprovodn., Kiev, USSR
Publisher: "Naukova Dumka" Address: Kiev, USSR
Abstract: mass spectrum dielectric semiconductor, gamma damage dielectric semiconductor, laser damage dielectric semiconductor

CA08414089396R
Use of the method of secondary ion emission for studying semiconductor materials
Author: Vasiliev, E. A., Zhukov, A. G.
Location: Sarat. Gos. Univ., Saratov, USSR
Publisher: "Naukova Dumka" Address: Kiev, USSR
Abstract: mass spectrum semiconductor, secondary ion semiconductor spectroscopy

CAO8414093930E
Evaluation of concentration-depth profiles by sputtering in SIMS and AES
Author: Hofmann, S.
Abstract: review secondary ion mass spectroscopy, depth profile detm review, surface analysis mass review, film analysis mass review
C904261889504
Empirical quantitation procedures in SIMS
Section: CA670011, CA099000 Pubi. Class: J
Identifiers: secondary ion mass spectrometry, quantitative ion mass spectrometry

C904261889505C
Surface analysis by secondary ion mass spectrometry techniques
Author: Dobrott, Robert D.
Section: CA670000, CA089000, CA099000 Pubi. Class: J
Identifiers: secondary ion mass spectrometry, surface analysis mass spectrometry review

C904261893618B
ESCA and SIMS as new processes to test glass and ceramics
Author: Schilladel, Helmut, Scholze, Horst
Section: CA657000, CA099000 Pubi. Class: J
Language: Ger
Identifiers: glass electron ion spectroscopy, ceramic electron ion spectroscopy, ruby electron ion spectroscopy

C90424172759E
SIMS applications in the investigation of surfaces, thin films and sandwich structures, with special regard to quantitative analyses

C90424165804X
Use of ion scattering and secondary ion mass spectrometry to characterize apparent "adhesive" failure in an adhesive bond
Author: Baum, W. L.
Location: Inst. Surf. Interactions Branch, Air Force Mater. Lab., Wright-Patterson AFB, Ohio
Section: CA650001, CA037000 Pubi. Class: J
Identifiers: adhesion failure detection, ion scattering detection, adhesive failure, mass spectrometry detection, adhesive failure

C904222157126C
Investigation of electroplated gold layers with secondary-ion-mass-spectrometry (SIMS)
Author: Kell, Albert
Location: Inoue-Strobe K.-G., Birkenfeld, Ger.
Section: CA672000 Pubi. Class: J
Identifiers: gold electroplating carbon inclusion

C904222156182F
Studies of the surface behavior of oxide catalysts by secondary ion mass spectrometry (SIMS)
Author: Barber, M., Sharpe, P. K., Vickerman, J. C.
Section: CA657001 Pubi. Class: J
Identifiers: oxide catalyst mass spectrometry, copper spinel catalyst mass spectrometry, magnesium copper aluminum catalyst
CA08506039825C
High mass resolution secondary ion mass spectrometry
Author: Williams, Peter. Evans, C. A. J.
Location: Water, Res. Lab., Univ., Illinois, Urbana, III.
Section: CA07901. CA079000. CA053000 Publ. Class: J
Coden: NXBSAV Publ.: 75 Series: 427. Pages: 63-8
Identifiers: high resol mass spectroscopy, labradorite high
mass resol spectra

CA08506028572U
Ion microprobe analyzer
Author: Kanomata, Ichiro, Dots, Hiroshi, Tamura, Hidumi
Location: Japan
Section: CA079002. CA079000 Publ. Class: P
Journal: U.S.
Coden: USAXMX Publ.: 751270 Pages: 11
Identifiers: ion microprobe analyzer, secondary ion mass
spectrometer, ion alloy analysis ion microprobe, silicon detn.
ion microprobe, aluminum detn ion microprobe, chromium iron
alloy analysis
Patent No: 3930115 Applic No: 73 7911 Date: 790119
Assignee: Hitachi, Ltd.

CA08506028705
Local chemical analysis of a solid sample
Author: Castel, Romain, Blaise, Guy, Quetlier, Roger
Location: Fr.
Section: CA079002. CA079000 Publ. Class: P
Coden: GMXX8X Publ.: 760115 Pages: 26
Identifiers: secondary ion mass spectrometer, ionization
chamber mass spectrometer, local solid analysis mass
spectrometry
Patent No: 25295556 Applic No: 74 22722 Date: 760238
Class: 601H Country: Fr.
Assignee: Agence Nationale de Valorisation de la Recherche

CA08506028697R
Application of SIMS microanalysis techniques to trace
element and isotopic studies in geochemistry and cosmochemistry
Author: Lohning, J. F.
Location: Dep. Geol., Univ. Melbourne, Parkville, Aust.
Section: CA079000 Publ. Class: J
Coden: NXBSAV Publ.: 75 Series: 427. Pages: 129-42
Identifiers: review secondary ion mass spectrometry, trace
element detn geochem review, isotopic ratio detn geochem review, geochem analysis secondary ion review, cosmochem analysis secondary ion review

CA085060201094X
Twinned molecular beam technique and static secondary
ion mass spectrometry applied to catalytic reaction studies
and surface analysis
Author: Cavallini, M., Nencini, G.
Location: Lab. Ric. Base, SHW Progetti S.p.A., Monterotondo
Italy
Section: CA079001. CA079000. CA079000 Publ. Class: J
Identifiers: silver catalyst surface contamination. surface
catalysis silver detn, mass spectroscopy silver
catalysis, mol beam detn silver contamination

CA08426168354H
Some effects limiting SIMS depth profile analysis and
methods for improvement
Author: Lewis, Robert N.
Location: Careris, Insrum., Inc., Irvine, N.Y.
Section: CA07901. Publ. Class: J
Coden: NXBSAV Publ.: 76 Series: 400-23. Pages: 45-59
Identifiers: secondary ion mass spectrometry

CA08426168355F
Charging of insulators by ion bombardment and its
minimization for secondary ion mass spectrometry (SIMS)
measurements
Author: Werner, H. W., Morgan, A. E.
Location: Philips Res. Lab., Eindhoven, Neth.
Section: CA07901. Publ. Class: J
Coden: UAPIAU Publ.: 76 Series: 67 Issue: 4 Pages: 1222-2
Identifiers: mass spectrometry, insulator, insulator charging
ion bombardment
CA08510071556B
Comparison of Auger electron spectroscopy (AES) and secondary ion mass spectrometry (SIMS)
Author: Morapito, J. M.
Location: Bell Telephone Lab., Inc., Allentown, Pa.
Section: CA079000 Pub1 Class: J
Identifiers: review secondary ion mass spectrometry, Auger electron spectroscopic analysis review, surface analysis spectrometry review

CA08508056345F
Electronic optical apparatus for ion scattering spectrometry and mass spectrometry of secondary ions
Location: Gen.
Section: CA079002, CA076000 Pub1 Class: P
Journal: Fr. Demande Coden: FRKXBL Pub1: 751024
Pages: 8 pp.
Identifiers: surface analysis app, spectrometer mass ion scattering, secondary ion mass spectrometer, ion scattering spectrometer surface analysis
Patent No: 2265163 Appl. No: P 24 14 221 0 Date: 740325 Class: OIN, H01 Country: Ger.
Assignee: Max-Planck-Gesellschaft zur Forderung der Wissenschaften e.V.

CA08508056095G
A high mass resolution capability for the Cameca ion analyzer
Author: Lewis, R. K., Vastel, J.
Location: Cameca Instrum., Inc., Elmsford, N. Y.
Section: CA079002, CA076000 Pub1 Class: C
Identifiers: Cameca ion analyzer high resolution, secondary ion mass spectrometer

CA08508056064W
The use of Auger electron spectroscopy and secondary ion mass spectrometry in the microelectronic technology
Author: Morapito, J. M., Lewis, R. K.
Location: Bell Lab., Allentown, Pa.
Section: CA079000, CA076000 Pub1 Class: J
Identifiers: review spectrometry microelectronic material, Auger electron spectroscopy review, secondary ion mass spectrometry review, electronics analysis spectros copy review

CA08508056040R
SIMS (secondary ion mass spectroscopy), a new method for the analysis of surfaces and thin layers
Author: Kucera, Jaroslav
Section: CA079000, CA076000 Pub1 Class: J
Identifiers: review surface analysis mass spectroscopy, secondary ion mass spectrometry review, thin layer mass spectroscopy review, layer analysis mass spectroscopy review

CA08508055304N
Surface ionization - "plasma" in disguise
Author: Coles, John N.
Section: CA076005 Pub1 Class: J
Identifiers: surface ionization plasma secondary emission, mass spectroscopy secondary ion

CA08508050438P
A comparison of the techniques for silicon surface analysis
Author: Evans, Charles A., Jr.
Section: CA079006, CA066000 Pub1 Class: J
Identifiers: silicon surface analysis spectrometry, Auger electron spectroscopy silicon analysis, ESCA silicon surface analysis, ion scattering spectrometry silicon analysis, secondary ion mass spectrometry silicon, mass spectrometry silicon surface analysis
Simultaneous ion-scattering and secondary-ion mass spectrometry
Author: Vassie, Michael J., Malin, Donald L.
Location: Bell Lab., Murray Hill, N. J.
Section: CA075061, CA075000 Publ Class: J
Publ: 79 Issue: 2 Pages: 145-57
Identifiers: spectrometer ion scattering mass spectroscopy

Cluster induced secondary electron emission
Author: Staude, M., Hofer, W. D., Liebl, H.
Section: CA076005 Publ Class: J
Publ: 76 Series: 25 Issue: 1-2 Pages: 103-12
Identifiers: cluster ion secondary electron emission, mass spectroscopy cluster ion

Secondary-ion mass spectrometry, a new process for solid state analysis
Author: Maul, Johann L.
Location: Ger.
Section: CA076000, CA076000, CA086000 Publ Class: J
Journal: Chem.-Tech. (Heidelberg) Coden: CMTKAF
Publ: 76 Series: 5 Issue: 17-19 Pages: 17-19 Language: Ger
Identifiers: review secondary ion mass spectroscopy

Studies on copper-nickel and copper-aluminum systems with secondary ion mass spectrometry (SIMS)
Author: Rodriguez-Marcia, M., Beska, M. E.
Section: CA085007, CA076000 Publ Class: T
Journal: Ber. Kernforschungsanlage Juelich Coden: BKJES
Language: Ger
Identifiers: copper-aluminum ionization ratio, nickel copper ionization ratio, secondary ion mass spectroscopy

The oxidation of aluminum studied by SIMS at low energies
Author: Dawson, P. H.
Section: CA076011, CA086000 Publ Class: J
Identifiers: aluminum oxide ion mass spectroscopy

A study of germanium/silicon dioxide MIS structures by the use of secondary ion mass spectrometry
Author: Wang, K. L., Stones, H. A.
Section: CA076011 Publ Class: J
Publ: 76 Series: 47 Issue: 6 Pages: 2539-49
Identifiers: mass spectroscopy MIS structure, germanium silicium structure mass spectroscopy

Methods for obtaining in-depth data in surface analysis
Author: Hole, R., Storp, S.
Section: CA079000 Publ Class: J
Journal: Vak.-Tech. Coden: VARTAY
Publ: 76 Series: 25 Issue: 3 Pages: 73-8 Language: Ger
Identifiers: depth profile surface analysis review, Auger electron spectroscopy depth review, secondary ion mass spectrometry review, ESCA depth profile review, sputtering depth analysis review

Measurement of momentum accommodation coefficients on surfaces characterized by Auger spectroscopy, SIMS and LEED
Author: Seidl, M., Steinleitl, E.
Location: Dornier Syst. G.b.R., Friedrichshafen, Ger.
Section: CA085007, CA087000, CA086000, CA076000 Publ Class: J
Identifiers: accommodation coeff det and, beam atomic mu scattering surface, momentum transfer atomic beam surface, helium momentum accommodation coeff, helium accommodation coeff helium, cooper accommodation coeff helium, tungsten accommodation coeff helium, sapphire accommodation coeff helium, glass accommodation coeff helium, gold accommodation coeff helium
CA085262008800
Secondary ion mass spectrometry (SIMS). A technique for studying surface reactivity
Author: Barber, M., Vickerman, J. C.
Section: CA076000, CA068000 Publ. Class: J
Identifiers: review microelectronics Auger mass spectroscopy electronics Auger mass spectroscopy review

CA08525193065M
Secondary-ion emission of amino acids
Author: Benninghoven, A., Jasper, D., Sichtermann, W.
Section: CA034002, CA022000 Publ. Class: J
Identifiers: amino acid secondary ion emission, mass spectroscopy secondary ion amino acid

CA08524188523U
Detection of SiO2- ions from silica-silicon interface by means of SIMS
Author: Nakamura, Kazumitsu, Hirose, Hiroshi, Shibata, Atsumi, Tamura, Hifumi
Location: Naka Works, Hitachi Ltd., Katsuta, Japan
Section: CA078001 Publ. Class: J
Identifiers: silica-silicon interface ion, mass spectroscopy silica interface

CA08524185147Z
Auger and SIMS spectrometry in microelectronics

See the surface in another 'light'
Author: Reisch, Gerald E., Riggs, William M.
Section: CA076000, CA073000, CA076000 Publ. Class: J
Identifiers: surface analysis multiple spectrometric, ESCA Auger electron spectrometry, scanning Auger microprobe ESCA, UV photoelectron spectroscopy ESCA, secondary ion mass spectrometry, magnesium fluoride conversion oxide, molybdenum oxide catalyst poisoning
CA86102073238
A study of the effects of inhibitive and aggressive ions on oxide-coated aluminum using secondary ion mass spectrometry
Author: Abd Reago, M. F., Richardson, J. A., Wood, G. C., Jackson, C. K.
Section: CA0606008, CA076XXX Publ Class: JOURNAL
Identifiers: aluminum oxide coated corrosion, mass spectrometry corrosion aluminum

CA8610064238
Detection of aluminum and magnesium contamination in sputtered platinum films by Auger electron spectroscopy and secondary ion mass spectrometry
Author: Andrews, J. M., Moreboto, T. J. M.
Location: Bell Teleph. Lab. Inc., Murray Hill, N. J.
Section: CA076013 Publ Class: JOURNAL
Identifiers: platinum sputtered film contamination, magnesium contamination platinum film, aluminum contamination platinum film, integrated circuit platinum film, Auger electron spectroscopy platinum film, mass spectroscopy platinum film

CA8610064370
A simple electronic aperture for rastered-beam depth profiles
Author: Williams, Peter, Evans, Charles A., Jr.
Section: CA076011 Publ Class: JOURNAL
Identifiers: mass spectrometry depth profiling, spectrometry ion scattering depth profiling

CA8610064236
Study of an iodine discharge in a duoplasmatron
Author: Liebl, H., Harrison, W. W.
Location: Max-Planck-Inst. Plasmafys., Garching, Ger.
Section: CA076011 Publ Class: JOURNAL
Identifiers: iodine discharge duoplasmatron mass spectrometry, secondary ion mass spectrometry iodine

CA8610064370
A mass and energy spectrometer for secondary ion analysis
Author: Bayly, J. R., Macdonald, B. W.
Section: CA076011 Publ Class: JOURNAL
Identifiers: mass spectrometer secondary ion analysis, energy spectrometer secondary ion analysis, secondary ion analysis app
CA885140903630
High-sensitivity depth profiling of arsenic and phosphorus in silicon by means of SIMS

Abstract:
High-sensitivity depth profiling of arsenic and phosphorus in silicon by means of SIMS is described. The technique involves the use of a SIMS system to analyze the depth profile of these elements in silicon. This method is particularly useful for studying the distribution of dopants in silicon wafers, which is essential for the fabrication of semiconductor devices. The SIMS system used in this study is capable of detecting small amounts of arsenic and phosphorus with high precision, allowing for detailed analysis of the depth profile. The technique has significant implications for the semiconductor industry, as it enables the optimization of doping profiles to improve device performance.

CA906120632193
Quantitative secondary ion mass spectrometry analysis of oxygen isotopes and other light elements in silicon oxide films

Abstract:
Quantitative secondary ion mass spectrometry (QSIMS) was used to analyze oxygen isotopes and other light elements in silicon oxide films. This technique involves the use of a secondary ion mass spectrometer to detect and quantify the presence of these elements. The analysis revealed the distribution of oxygen isotopes and other light elements in the oxide films, which is crucial for understanding their properties and behavior. The results of this study have implications for the development of new silicon oxide materials with improved performance.

CA885140909772P
High-performance SIMS system

CA885140909771M
In-depth concentration profiling of garnet epilayers using secondary ion mass spectrometry

CA885140909769T
Application of secondary-electron capture negative-ion (SECI) mass spectrometry to the analysis of metal-organic compounds
CA68021480557
De-excitation processes near the surface of ion bombarded silicon dioxide and silicon
Author: Martin, P. J., Bayly, A. R., Macdonald, R. J., Tolk, N. H., Clark, G. J., Kelly, J. C.
Section: CA076003, CA0764XX Publ Class: JOURNAL
Identifiers: de-excitation process ion bombarded silicon, silicon deexcitation process ion bombarded silicon

CA6802148059U
Quantitative ion microanalysis of a steel surface
Author: Servais, J. P., Gruss, H., Leroy, V., Hefkens, L.
Location: Abbaye Val Benoit, Liege, Belg.
Section: CA076026 Publ Class: JOURNAL
Identifiers: steel surface microanalysis, secondary ion mass spectroscopy steel, cathode sputtering steel surface

CA6802133298U
Study of the composition of thallium nitride by secondary ion-ion emission
Author: Andreeva, A. F., Chentain, S. P.
Location: USSR
Section: CA079006 Publ Class: JOURNAL
Journal: Progress Poluchenie i Svoistva Tonkikh Pienok, Coden: D4JULS Publ: 78 Pages: 17-21 Language: Russ
Citation: Ref., Khim, 1976, Abstr. No. 18G125
Identifiers: thallium nitride analysis ion emission, secondary ion emission thallium nitride, mass spectroscopy thallium nitride

CA6802133299K
Auger-ESCA combined spectrometry for material characterization
Author: Schill, S., Chatel, J. L.
Location: Leybold Heraeus, Cologne, Ger.
Section: CA079006 Publ Class: JOURNAL
Identifiers: ESCA Auger spectroscopy surface analysis, copper analysis combined ESCA Auger, secondary ion mass spectroscopy copper

CA6802133287G
Analytical studies in the small-dimension range
Author: Than, Eberhard
Section: CA079001 Publ Class: JOURNAL
Issue: 1 Pages: 29 Language: Ger
Identifiers: microanalysis small dimension solid, efficiency small dimension solid analysis, information depth solid analysis, depth profile solid analysis

CA6802133207K
Surface analyzer combining secondary ion mass spectrometry and ion scattering spectrometry
Author: Ishitani, Tohru, Itch. Michiyasu, Tamura, Hisumi
Section: CA096011, CA09602X, CA09603X Publ Class: JOURNAL
Journal: Shitsuryu Bunken, Coden: SHIBAK Publ: 74 Series: 24 Issue: 3 Pages: 261-3
Identifiers: surface analyzer SIMS ISS, secondary ion mass spectroscopy analyzer, ion scattering spectrometry analyzer

CA6802131186K
SIMS study of element concentration profiles in enamel and dentin
Author: Frostell, G., Larsson, S. J., Lodding, A., Ocelius, M., Petersson, L. G.
Section: CA013001, CA09604X Publ Class: JOURNAL
Identifiers: tooth element detm. mass spectrometry tooth element
New apparatus for solid and surface analysis using high energy molecular beams

Surface ionization - "plasma" in disguise

Quantitative evaluation of SIMS-spectra using Saha-Egbert type equations

The use of the ion microprobe in industry

Evaluation of impurity and contamination levels on micro surfaces using SIMS

SIMS studies at metal surfaces

Detection of hydrogen in metals by the SIMS-method with quadrupole mass filter

The use of the ion microprobe in industry
CA08624182467P
Ion microprobe trace element analysis with high mass resolution
Author: Reed, S. J. B. Long, J. V. P., Coles, J. N., Astill, D. M.
Cambridge, Eng.
Identifiers: ion microprobe trace element detn, mass resol
ion microprobe analysis

CA08624181533V
Sputtering of thin films in an ion microprobe
Author: Hofer, W. D. Liebl, H.
Location: Max-Planck-Inst. Plasmaphys., Garching, Ger.
Meeting Date: 75
Publisher: Plenum Address: New York, N. Y
Avail.: Meyer, Otto; Linker, Gerhard; Kaeppeler, Franz
Identifiers: sputtering film ion microprobe, mass
spectroscopy film sputtering, titanium sputtering oxygen
coverage

CA08624181468C
Problems occurring in depth concentration profiling
Author: Burger, P. A., Blum, F., Schilling, J. H.
Pretoria, S. Afr.
Identifiers: depth conecon profiling, mass spectrometry depth profiling

CA086241814350
An apparatus for measuring the positive secondary ion
emission from solid surfaces
Author: Duestervoet, Heinz, Manns, Reiner, Rogawski, Siegfried
Identifiers: secondary ion emission app., solid surface,
secondary ion emission, metal secondary ion yield

CA08624181431h
Xenon(+) ion beam induced secondary ion (silicon(+)) yield
from silicon-metal interfaces
Author: Narusawa, T., Satake, T., Komiya, S., Shimizu, A.,
Iwami, M., Hiraki, A.
Location: ULVAC Corp., Chigasaki, Japan
Meeting Date: 75
Publisher: Plenum Address: New York, N. Y
Avail.: Meyer, Otto; Linker, Gerhard; Kaeppeler, Franz
Identifiers: silicon sputtering yield xenon, gold silicon
sputtering, surface silicon xenon sputtering, mass
spectra silicon sputtering

CA08624177785W
New methods of studying solid state surfaces
Author: Benninghoven, Alfred
Identifiers: PHEL adsorption surface structure,
photoelectron spectroscopy adsorption review, Auger
spectroscopy adsorption review, mass spectroscopy adsorption
review, analysis surface electron spectra review

CA08624177784K
Monolayer analysis of contaminated surfaces
Author: Hole, Reiner, Stem, Siegfried
Location: Ingenieurin, Angew. Phys., Bayer A.-G.,
Leverkusen, Ger.
Identifiers: PHEL analysis surface analysis, Auger spectroscopy
surface review, mass spectroscopy surface review,
photoelectron spectroscopy surface review, ion scattering
surface review, electron microscopy surface review, IR
spectroscopy surface review
CA006626192345J
Application of secondary ion mass spectrometry in the research of tungsten
Author: Kussa, Laszlo, Riedel, Miklos
Location: Fiz. TEMA. Estvos Lorenz Tudomanyo., Budapest, Hung.
Identifiers: iron grain boundary diffusion tungsten, nickel grain boundary diffusion tungsten, mass spectrometry secondary ion tungsten

CA006626192332J
Surface techniques for the study of materials: AES, ESCA. SIMS
Author: Marcus, H. L.
Location: Univ. Texas, Austin, Tex.
Identifiers: review alloy surface examn, Auger electron microscopy alloy review, mass spectrometry alloy surface review
CA08704031210
Use of ion and electron microprobes for full characterization of particulate matter
Author: Gavrilovic, John, Majewski, Elizabeth
Location: Walter E. McCone Assoc., Inc., USA
Section: CA079001 Publ Class: JOURNAL
Journal: Am. Lab. (Fairfield, Conn.) Coden: ALBYBL
Publ: 77 Series: 9 Issue: 4 Pages: 19-21, 24-5, 27-8
Identifiers: electron microprobe particle analysis, ion microprobe particle analysis, secondary ion mass spectrometry particle

CA08704027207
SEM + SIMS: a unique combination for surface characterization
Author: Leys, J. A., McKinney, J. T.
Location: Cent. Res. Lab, 3M Co., St. Paul, Minn.
Section: CA056005 Publ Class: JOURNAL
Identifiers: electron microscopy scanning surface, mass spectrometry secondary ion, aluminum silicon surface analysis, glass fluorocarbon coating analysis

CA08702015503W
Depth profile detection limit of 3 times 1015 atoms cm-3 for arsenic in silicon using cesium ion bombardment negative secondary ion mass spectrometry
Author: Williams, Peter, Evans, Charles A., Jr.
Section: CA079006, CA076010 Publ Class: JOURNAL
Identifiers: arsenic depth profile, silicon, secondary ion mass spectrometry silicon, cesium ion source mass spectrometry, neg secondary ion mass spectrometry

CA08702015421H
Investigations on copper-nickel and copper-aluminum systems with secondary ion mass spectrometry (SIMS)
Author: Rodriguez-Munilla, H., Bask, M. E.
Location: Zentralabt., Chem. Anal., KFA, Juelich G.R.W.
Juelich, Ger.
Section: CA079006 Publ Class: TECH REP
Citation: INIS Atominform 1976, 7(23), Abstr. No. 27412
Available: INIS
Identifiers: secondary ion mass spectrometry analysis, alloy analysis mass spectrometry, copper alloy analysis mass spectrometry, aluminum alloy analysis mass spectrometry, ionization coeff mass spectrometry, cluster ion mass spectrometry

CA08702015350J
Newer methods for surface analysis
Author: Holle, R.
Location: Leverkusen, Ger.
Section: CA079000 Publ Class: CONF PROC
Publisher: VDI-Verlag Address: Dusseldorf, Ger
Available: Tueller, Heinrich
Identifiers: new methods surface analysis, secondary ion mass spectrometry analysis, Auger spectroscopy surface analysis review, X-ray photoelectron spectroscopy review, photoelectron spectroscopy surface review
CA08708061974P
Study of solid surfaces by secondary-ion mass spectrometry (SIMS)
Author: Vancée, I.
Location: Institut. d'Etudes, Cluj-Napoca, Rom.
Section: CA0794900, CA0766XX
Publi Class: JOURNAL
Identifiers: review secondary ion mass spectrometry, surface analysis mass spectrometry review

CA08708057278V
Secondary ion mass spectrometry for diffusion studies in glass
Author: Inoue, Atsushi, Iino, Akira
Location: Fac. Eng., Nagoya Univ., Nagoya, Japan
Section: CA057001
Publi Class: JOURNAL
Identifiers: glass silver sodium diffusion, silver diffusion glass cation exchange, sodium diffusion glass cation exchange, cation exchange diffusion glass

CA08708047595J
A quadrupole instrument for investigations of electron and ion beam interactions with solids
Author: Potovsky, J. C., Mittry, D. B.
Section: CA0794900
Publi Class: JOURNAL
Identifiers: quadrupole mass spectrometer-solid, secondary ion mass analyzer solid, ion beam interaction solid, electron beam interaction solid

CA087080475678
Analysis of solid surface monolayers by mass and energy spectrometry methods
Author: Treitz, Norbert
Section: CA0794900
Publi Class: JOURNAL
Identifiers: review surface analysis spectrometry, mass spectrometry surface analysis review, energy spectrometry surface analysis review

CA08706044769h
SIMS, EID and flash-filament investigation of oxygen, hydrogen, (oxygen + hydrogen) and water interaction with vanadium
Author: Benningsen, A., Mueller, K. H., Plück, C., Schenker, M., Steffens, P.
Section: CA057003, CA0668XX, CA0766XX
Publi Class: JOURNAL
Identifiers: vanadium reaction hydrogden oxygen water, oxygen reaction vanadium surface, hydrogen reaction vanadium surface, water reaction vanadium surface, mass spectrometry vanadium surface reaction

CA08704033236F
Quantitative multielement analysis with SIMS
Author: Fraule, R. D., Conrado, R. L.
Section: CA0794906
Publi Class: JOURNAL
Identifiers: secondary ion mass spectrometry analysis, multielement analysis mass spectrometry

CA08704033191N
Semiquantitative analysis of alloys with SIMS
Author: Gerlach, R. L., Davis, L. E.
Section: CA0794906
Publi Class: JOURNAL
Identifiers: alloy analysis mass spectroscopy, secondary ion mass spectroscopy alloy, nickel alloy analysis mass spectroscopy, silicon detn alloy mass spectroscopy, transition metal detn alloy
CA807120942510
Application of characteristic secondary ion mass spectra to a depth analysis of iron aluminum oxide
Author: Kitada, Akinoko, Temura, Hifumi
Location: Nippon Coll. Health Phys. Educ., Tokyo, Japan
Section: CA0756011, CA0552XX, CA0792XX
Publ Class: JOURNAL
Journal: Shitsuryo Bunseki
Coden: SHIBAK
Publ: 77
Series: 25
Issue: 1
Pages: 85-9
Identifiers: mass spectrometry secondary ion oxide, iron aluminum oxide depth analysis, conc profile iron aluminum oxide
CAS Registry Numbers: 1114-20-8 7429-90-5 7439-89-6 1344-28-1 1309-37-1

CA80712091715
Twin modulated supersonic beam apparatus applied to interaction with a surface chemically analyzed by S.S.M.S
Author: Cavallini, M., Nencini, G.
Location: Lab. Ric. Base, Nangropetti S.P.A., Rome, Italy
Section: CA068003
Publ Class: CONF PROG
Journal: C. R. - Symp. Int. J. Mol., $\text{th}$ Coden: 36GLAC
Publ: 75
Pages: Paper No. 84, 10 pp.
Publisher: Com. Int. J. Mol., c/o Dr. F. Marcel Devienne
Address: Paymeinade, Fr
Identifiers: secondary ion mass spectrometry surface, water adsorption interaction silver surface
CAS Registry Numbers: 7440-22-4 7732-18-5 7440-37-1

CA8071209164Y
Construction and operating parameters of the mass spectrometric part of the apparatus for studying the reaction of liquid metals with gases by secondary ion-ion emission
Author: Pokhodnya, I. K., Shvechko, V. I., Alabushiev, D. G., Komissa, A. D.
Location: Khar'k. Gos. Univ. im. Gor'kogo, Khar'kov, USSR
Section: CA056007, CA0792XX
Publ Class: TECH REP
Journal: Deposited Doc.
Coden: OBDEP2
Publ: 75
Issue: VINITI 2783-75
Pages: 111-13
Language: Russ
Identifiers: gas metal reaction spectrometry, mass spectrometer ion emission

CA80712090164Y
Descriptors: Metals, reactions: mass spectrometers and spectrophotographs, secondary-ion
Identifiers: gases study gas molten

CA807120909048P
Analysis of the surface of platinum-rhodium alloys by x-ray photoelectron spectrometry and secondary ion mass spectrometry
Author: Biais, C., Contour, J. P., Leclere, C.
Section: CA068006, CA066XX
Publ Class: JOURNAL
Coden: UMSFED
Publ: 76
Series: 1
Issue: 2
Pages: 247-84
Language: Fr
Identifiers: platinum rhodium surface analysis

CA80712088668B
Phase analysis in steel by secondary ion mass spectrometry
Author: Rautiapierre, P., Nandri-Riadi, R., Rofes-Vernis, J.
Trucos, B., Henry, G.
Section: CA055207
Publ Class: JOURNAL
Coden: PSCOB
Publ: 76
Series: 11
Identifiers: steel phase analysis mass spectrometry, niobium carbide ptn steel, carbide ptn detn steel

CA80712088668B
Descriptors: Mass spectrometry, secondary-ion
Identifiers: solid ptn. (NDH) ptn high Ni stainless steel carbide niobium carbide phase analysis base carbonitride
CAS Registry Numbers: 12069-94-20 24621-31-40 63665-11-2
Comparison of surface sputtering characteristics by a low energy secondary ion mass analysis using a quadrupole type analyzer with those using an Auger electron spectrum analysis.

Descriptors: Mass spectrometers and spectrophotographs, quadrupole, secondary ion.

Identifiers: Surface analysis, secondary ion mass spectrometry, surface analysis review, Auger spectroscopy surface analysis review, ESCA surface analysis review.

Local surface analysis - a new area of microchemical methods of work.

Authors: Holm, R.


Identifiers: review local surface analysis, secondary ion mass spectrometry, secondary ion mass spectrometry surface analysis review, Auger spectroscopy surface analysis review, ESCA local surface analysis review.

Relative ion sputtering yield measurements by integration of secondary ion energy distribution using a retarding-dispersive ion energy analyzer.

Authors: Krauss, A. R., Grun, D. M.


Identifiers: Ion sputtering yield detm, mass spectrometer sputtering yield, energy analyzer sputtering yield.

Sensitivity effects in the analysis of nickel-chromium-iron alloys by EMMA.

Authors: Brown, J. D., Gros, D. J., Von Rosenstiel, A. P., Kolster, B. H.

Location: Metallinst., THO, Apeldoorn, Neth.


Identifiers: ion microprobe analysis alloy, ion analysis ion microprobe, chromium iron alloy microprobe analysis, nickel iron alloy microprobe analysis.

An assessment of some techniques available for the local detection of hydrogen in metals.

Authors: Marsh, G. P.


Identifiers: tritium autoradiography hydrogen detection metal, neutron radiographic hydrogen detection metal, nuclear microprobe hydrogen detection metal, metal local analysis hydrogen, secondary ion mass spectrograph hydrogen, steel analysis hydrogen embrittlement, titanium alloy analysis hydrogen.
CA08716125655U
Descriptors: Films;Particles;Electron microprobe analysis;Photoelectron spectroscopy,ESCA;Mass spectroscopy,secondary-ion; Electron microprobe film identification particle, mass spectroscopy film identification particle
Identifiers: identification small thin

CA08716125655A
An instrument for secondary ion mass spectroscopy
Location: Ger.
Section: CA08716125655A
Publisher: Com. Int. Jets Mol., c/o Dr. F. Marcel Devienne
Address: Peymeinade, Fr.
Identifiers: secondary ion mass spectroscopy,org, mol beam org film analysis, film org analysis mass spectroscopy
**CA087181452450**

Quantitative analysis of hydrogen in titanium with an ion microanalyzer

Authors: Okajima, Toshihiko, Aizawa, Yukiyoshi, Suzuki, Katsumi, Sugahara, Yasushi

Location: Hitachi Res. Lab., Hitachi, Ltd., Hitachi, Japan


Identifiers: hydrogen detn titanium ion microprobe; secondary ion mass spectroscopy hydrogen; mass spectroscopy microprobe hydrogen detn; titanium analysis hydrogen

**CA087181452451**

Descriptors: Mass spectroscopy; secondary-ion; microprobe; Trace elements; Plagioclase

Identifiers: Analy energy selection quan detn

**CA087181447954**

Development and applications of the quadrupole-type secondary- ion mass spectrometer (QSIMS)

Authors: Kusao, Kenji, Yoshikawa, Yoshiaki, Konishi, Fumiyu

Location: Cent. Res. Lab., Matsushita Electr. Ind. Co., Osaka, Japan


Identifiers: secondary ion mass spectrometer; quadrupole type mass spectrometer

**CA087181447955**

Descriptors: Mass spectrometers and spectrographs; quadrupole secondary-ion

**CA087181447971**

Study of the nature of the mass spectra of positive and negative secondary ions knocked out by an argon(+) ion beam from the surface of Group III-V semiconductors


Location: Khark. Gos. Univ. im. Gorkogo, Kharkov, USSR


Identifiers: secondary ion mass spectra; aluminium gallium arsenide ion emission; phosphide gallium secondary ion emission

**CA078181447477**

Descriptors: Mass spectrometers in gases

Identifiers: Solid soln. gallium arsenide secondary emitted bombarded argon aluminium compounds properties Group III-V semiconductors secondary emission

CAS Registry Numbers: 22831-42-10 1203-00-00 1203-98-8 14791-09-6
CA0672171736V
Semiquantitative analysis by secondary ion mass spectrometry
Author: Morgan, A. E., Werner, H. M.
Location: Philips G.m.b.H. Forschungsab, Hamburg, Hamburg, Ger.
Section: CA057001, CA053XXX, CA056XXX, CA073XXX, CA079XXX
Publ Class: JOURNAL
Publ: 77 Series: 2 Issue: 3 Pages: 265-290
Identifiers: glass analysis ion mass spectrometry, mineral analysis ion mass spectrometry, alloy analysis ion mass spectrometry.

CA0672171736V
Descriptive: Glass, oxide; Alloys, analysis; Minerals
Identifiers: det<sub></sub>n secondary ion mass spectrometry
Dorsouilhac

CA0672016043V
Use of an electron gun for insulator analysis with an ion analyzer
Author: Blanchard, B., Carrier, P., Hilleret, N., Marguerite, J. L., Rocca, J. C.
Location: EEN, Grenoble, Fr.
Section: CA076003 Publ Class: CONF PROC
Publisher: G.A.M.S. Address: Paris, Fr.
Identifiers: electron gun insulator analysis, secondary ion emission, insulator, boron profile, silica, garnet profile, sodium profile, gallate, rare earth profile, garnet profile, iron, iron gallate profile, rare earth profile.

CA0672016043V
Descriptors: Electron gun, Mass spectroscopy, secondary-ion; Electric insulators and Dielectrics; Rare earth metals, gallate, ferrite, compounds, ferrite, substances, garnet
Identifiers: isotope, mass spectrometry, techniques, secondary-ion mass spectrometry, gallate, ferrite, compounds, gallate, ferrite, iron, rare earth.
CAS Registry Numbers: 7831-86-9 7440-22-0 7440-23-5

CA067201574515
Surface structure of inorganic solid by secondary ion mass spectrometry
Author: Kyoto, Michihisa, Bando, Yoshichika
Location: Inst. Chem. Res., Kyoto Univ., Uji, Japan
Section: CA066000, CA067XXX, CA075XXX Publ Class: JOURNAL
Journal: Kagaku (Kyoto) Coden: KARYAU Publ: 77 Series: 32 Issue: 2 Pages: 146-50 Language: Japan
Identifiers: crystal structure, mass spectroscopy, review, catalyst surface mass spectroscopy review.

CA067201574515
Descriptors: Surface structure; Mass spectroscopy, secondary-iron; Crystal structure determination
Identifiers: iron solids, inorganic surfaces.

CA06720152699U
Use of secondary-emission mass spectrometry to determine the mutual orientation of monomer units in macromolecules of fluorine-containing copolymers
Author: Tantsyrev, G. D., Pavlotshkaya, M. I., Klimov, N. A.
Section: CA035006 Publ Class: JOURNAL
Identifiers: mass spectrometry, polymer microstructure, fluorine-containing copolymer, fluorine-containing ethylene vinylidene fluoride copolymer.

CA06720152699U
Descriptors: Chains, chemical; Mass spectroscopy, secondary-ion; Microstructure; Deuterium triple resonance, sensitivity.
Identifiers: mass spectrometry, polymer, fluorine-containing copolymer.
CAS Registry Numbers: 25564-78-8 9010-75-7

CA06718145281Y
Revised calculation of oxygen concentration in the LTE model
Author: Brown, J. D., Von Rosenstiel, A. P.
Location: Kalamazoo, Mich., Apedorn, Neth.
Section: CA079006 Publ Class: JOURNAL
Identifiers: oxygen, calcium, local thermodynamic equilibrium, secondary-ion mass spectrometry, mass spectrometry, oxygen, calcium.

CA06718145281Y
Identifiers: analysis, calcium, local thermodynamic equilibrium, secondary-ion mass spectrometry, mass spectrometry, calcium.
CAS Registry Numbers: 7782-44-7
CA08724193074E
Quantitation of secondary ion mass spectrometric images by microphotodensitometry and digital image processing
Author: Fassett, J. D.; Roth, J. R.; Morrison, G. H.
Location: Dep. Chem., Cornell Univ., Ithaca, N. Y.

CA08724193074E
Descriptors: Mass spectrometry, secondary-ion, microprobe; Computer application; Computer program; Densitometry, microphotography
Identifiers: quantitation photon images microphotodensitometry digital image processing mass spectrometry

CA08724192640Z
Use of the mass spectrometry of secondary ions method for studying processes on the surface and inside solids
Author: Koval, A. G.
Location: USSR

CA08724192640Z
Descriptors: Mass spectrometry, secondary-ion; Surface; Solids Identifiers: studies spectrometry study

CA08724189849U
A study of the interaction of oxygen with chromium using ion bombardment induced photon and secondary ion emission
Author: Macdonald, R. U.; Martin, P. J.

CA08724189849U
Descriptors: Mass spectrometry, secondary-ion; Photon Identifiers: properties interaction chromium bombardment argon ions oxygen uses miscellaneous presence emission metals effect

CAS Registry Numbers: 7782-44-7 7440-47-3 14791-69-6 7440-47-301 11118-57-9
Possibility of determining nickel and cobalt impurities on the surface of platinum by using secondary ion mass emission

Author: Kuchenev, V. L.; Nikitushina, L. N.
Location: Khm., Gos. Univ. im. Gor'kogo, Kharkov, USSR
Section: CA0779002 Publ Class: TECH REP
Availability: BLDO

Identifiers: nickel, cobalt, platinum surface, platinum surface analysis, cobalt nickel, mass spectrometry secondary ion.

CAS Registry Numbers: 7440-48-4 7440-02-0 7440-06-4 830-08-0

Mass spectrometric apparatus with double analysis of secondary ions

Author: Sidorenko, Yu. V.; Koval, A. G.; Kozlov, V. F.
Location: Khm., Gos. Univ. im. Gor'kogo, Kharkov, USSR
Section: CA0779002, CA076520A Publ Class: TECH REP
Availability: BLDO

Identifiers: mass spectrometer secondary ion, double analysis secondary ion.

A comparison of quantitative models for SIMS analysis

Author: Ruedener, F. G.
Location: Oesterr. Stadtwes, Atomenerg. m.b.H., Vienna, Austria
Section: CA0799001 Publ Class: JOURNAL

Identifiers: quantitative model, mass spectrometry, secondary ion mass spectrometry model.

Applications of secondary ion mass spectrometry (SIMS)

Author: Waner, H. W.
Location: Philips Res. Lab., Eindhoven, Neth.
Section: CA0779002 Publ Class: JOURNAL

Identifiers: method, mass spectrometry, secondary ion.
CA08802015303X
Combined SIMS/SEM for three dimensional surface analysis
Author: Sparrow, Gene R.
Identifiers: review three dimensional surface analysis, secondary ion mass spectroscopy review, mass spectroscopy surface analysis review, electron microscopy surface analysis review

CA08802015303X R
Descriptors: Mass spectroscopy, secondary-ion; Microscopy, electron, scanning; Surface structure
Identifiers: combined 3 dimensional anal

CA088020149477
Irradiation effects in SIMS analysis, their consequences on depth resolution
Author: Limoge, Y., Seguin, R., Saran, J. L.
Location: CIN, CEA, Saclay, Fr.
Identifiers: secondry ion mass spectrometry irradi, silicon secondary ion mass spectrometry, silica secondary ion mass spectrometry, aluminum secondary ion mass spectrometry, nickel secondary ion mass spectrometry, copper secondary ion mass spectrometry

CA088020149477
Descriptors: Mass spectroscopy, secondary-ion
Identifiers: properties film substrate systems irradiation effects depth resolution analysis relation
CAS Registry Numbers: 7440-21-3 7631-85-9 7440-02-0 7429-90-5 7440-50-8

CA088020149465
Improved SIMS depth profiles by control of sample surface potential
Author: Whitley, T. A., Conrad, R. L., Frielick, R. D.
Identifiers: secondary ion mass spectrometry, surface potential control sample mass spectrometry

CA088020149465
Descriptors: Mass spectroscopy, secondary-ion; Electric potential, surface
Identifiers: control sample improved depth profiles samples

CA088020149459
DIOD - a multipurpose scanning ion microprobe
Author: Wittbeck, K.
Identifiers: scanning ion microprobe DIOD, mass spectrometer secondary ion

CA088020149458
Descriptors: Mass spectrometers and spectrographs, secondary-ion; Analysis, ion microprobe; Biological materials
Identifiers: multipurpose scanning based app study

CA088020149440
Extension of SEM capabilities with SIMS
Author: Nauman, D. A.
Location: West. Electr., Indianapolis, Indiana
Identifiers: scanning electron microscopy SIMS, secondary ion mass spectrometry microscopy, film circuit microscopy spectrometry

CA088020149440
Descriptors: X-ray analysis, energy-dispersive; Electric circuits, film; Microscopes, scanning electron; Mass spectroscopy, secondary-ion
Identifiers: combined study thin spectrometry
CA8803018515Y
Empirical standards for quantitative analysis of biological tissues by secondary ion mass spectrometry
Author: Belknap, Margaret B.; File, David M.
Location: Albert Einstein Coll. Med., Bronx, N. Y.
Identifiers: mass spectrometry secondary ion, biological tissue mass spectrometry, trace element mass spectrometry

CA8803018515Y
Descriptors: Mass spectrometry, secondary-ion; Trace elements; Gelatin, analysis; Standard substances
Identifiers: dental biological material spectrometry film stds lipid-sol. derivs. compounds tissue vol metal tissues films std
CAS Registry Numbers: 7449-93-2 7440-17-7 7440-24-6 7440-50-8 7440-62-20

CA8802015529Y
Analyzer with ion microprobe
Author: Tamura, Hiroshi; Ishiz. Toru, Hinano, Tokuro
Location: Japan
Identifiers: ionizer analysis ion microprobe, film thin analysis ion microprobe, surface charging ion microprobe, ion micro-probe beam selection and
Patent No: 2659385 Appl. No: 76/4928 Date: 760121 Class: G01R9/25 Country: Japan
Assignee: Hitachi, Ltd.

CA8802015529Y
P
Descriptors: Electric insulators and Dielectrics; Films, thin; Mass spectrometry, secondary-ion; Mass spectrometers and spectrographs, secondary-ion
Identifiers: analog primary beam selection nonconductive selector

CA88020155277
Analysis using an ion microanalyzer
Author: Araki, Masaich. Oka, Yoshiaki
Location: Japan
Identifiers: secondary ion mass spectrometry analysis, halogen scavenger mass spectrometry, bromine scavenger mass spectrometry

CA88020155277
Patent No: 77 69381 Appl. No: 76/5734 Date: 760121
Class: G01N23/221 Assignee: Hitachi, Ltd.

CA88020155277
X
Descriptors: Halogens; Mass spectrometry, secondary-ion
Identifiers: uses miscellaneous scavenger hydrogen add
Identification chamber anal
CAS Registry Numbers: 7726-95-6

CA8802015506K
Some results on the quantitative analysis of silicates
Author: Stolzian, G.; Hevette, A.
Identifiers: silicate rock analysis mass spectrometry, change effect rock analysis, secondary ion mass spectrometry rock

CA8802015506K
X
Descriptors: Rocks, silicate; Mass spectrometry, secondary-ion
Identifiers: analog change effect

CA8802015407D
Correction of secondary ion intensity by a new total ion monitoring method
Author: Kubayashi, M.; Suzuki, K.; Yamasawa, Tanura, M.; Ishitani, T.
Location: Fund. Res. Lab., Nippon Steel Corp., Kawasaki, Japan
Identifiers: microprobe analysis secondary ion monitoring, steel fracture surface microprobe analysis, shadow mask ion micro-probe analysis

CA8802015407D
X
Descriptors: Surface, Mass spectrometry, secondary-ion; Mass spectrometers and spectrographs, secondary-ion
Identifiers: analog total monitoring method surfaces monitor
A new secondary ion emission microanalyzer.

**Title:** Mass spectrometry, secondary-ion: Mass spectrometry, secondary-ion emission microanalyzer.

**Publication:** Journal of Microscopy, vol. 134 issue 2 pages: 133-139

**Identifiers:** Journal of Microscopy, Secondary-Ion, Mass Spectrometry, Micro-analysis

**Abstract:**

The development and application of a new secondary ion emission microanalyzer are described. The instrument is designed for use in the analysis of small samples, particularly in the field of surface science. The design features include a high-resolution, low-background detector system and a computer-controlled sample stage for manipulation of the sample during analysis.

**Keywords:**
- Mass spectrometry
- Secondary ion emission
- Microanalysis

This new microanalyzer offers significant improvements in sensitivity and spatial resolution, making it a valuable tool for a wide range of scientific applications, including materials science, geology, and biology.
Use of Auger electron spectroscopy profile analysis and secondary ion mass spectrometry in the study of changes in surface layer composition.

**Authors:** Schneider, Helga

**Location:** Inst. Mater.-Festkoerperforsch., Kernforschungscenter Karlsruhe, Karlsruhe, Ger.

**Journal:** Microchim. Acta. Publ Class: JOURNAL. Publ: 77 Series: 2 Issue: 5-6 Pages: 437-46 Language: Ger

**Identifiers:** Auger electron spectroscopy profile analysis, secondary ion mass spectrometry, surface layer composition, sodium corrosion mass transfer, Stellite 68 corrosion sodium, reactor material corrosion sodium.
CA088100656555
Quantitative ion probe measurement using matrix ion species ratios
Author: Ganje, J. D., Leta, D. P., Morrison, G. M.
Location: Dep. Chem., Cornell Univ., Ithaca, N. Y.
Section: CA079008 Publ Class: JOURNAL
Identifiers: ion microprobe anal. quant. calibration quant. ion microprobe analysis, matrix ion species ratio microprobe, steel analysis ion microprobe, alloy analysis ion microprobe, aluminum alloy analysis ion microprobe. copper alloy analysis ion microprobe.

CA088100655555
Descriptors: Mass spectrometry, secondary-ion microprobe; ion beams; microprobes
Identifiers: analysis anal. matrix species ratios empirical calibrations Aluminum alloy nodule copper quant. calibration
CAS Registry Numbers: 12587-89-2

CA088100653112
Ion-implanted selenium profiles in gallium arsenide as measured by secondary ion mass spectrometry
Section: CA076913 Publ Class: JOURNAL
Identifiers: selenium implant gallium arsenide.

CA088100653112
Descriptors: Diffusion
Identifiers: properties implantation profile selenium annealing effect gallium arsenide implants
CAS Registry Numbers: 1303-00-0 7792-49-2

CA088100649410
Study of adhesive bonding and bond failure surface using ISS-SIMS
Author: Baun, M. L.
Location: Mech. Surf. Interactions Branch, Air Force Mater. Lab., Wright-Patterson AFB, Ohio
Identifiers: adhesive bonding failure aluminum, surface adhesive bonding failure.

CA088100649410
Descriptors: Adhesives; Surface anal.
Identifiers: bonding aluminum alloys failure relation base
CAS Registry Numbers: 37301-61-4 12861-84-1

CA08810062593w
Cationization of organic molecules in secondary ion mass spectrometry
Author: Gage, H., Winograd, N., Cooks, R. G.
Location: Dep. Chem., Purdue Univ., West Lafayette, Indiana
Section: CA03462, CA02299 X Publ Class: JOURNAL
Identifiers: secondary ion mass spectra amino acid, cationization secondary ion mass spectra, metal amino acid mass spectra.

CA08810062593w
Descriptors: Amino acids, properties; Metals, uses and miscellanous; Mass spectra, secondary ion
Identifiers: spectrum silver platinum, aluminum mass-spectroscopic
CAS Registry Numbers: 150-13-0 63-91-2 7440-22-4 7440-06-4 7447-41-8

CA08810057936F
Quantitative analysis of compound semiconductors with an ion microanalyzor
Author: Ono, Masaharu
Section: CA079006 Publ Class: JOURNAL
Identifiers: silicon, germanium, mass spectroscopy, gallium arsenide analysis silicon, semiconductor analysis mass spectroscopy, secondary ion mass spectroscopy, ion microanalyzor mass spectroscopy.

CA08810057936F
Descriptors: analysis, content, gallium arsenide, secondary ion mass spectroscopy, indium, impurity, solid, solid, compounds
CA0881207961BF
Simultaneous SIMS-AES measurements for partially oxidized aluminum surfaces
Authors: Narusawa, T., Homiya, S.
Location: UVAC Corp., Chigasaki, Japan
Section: CA060003, CA067XX
Publ. Class: CONF PROD
Publ: 77 Series: 2 Pages: 1329-32
Publisher: W. Dobrozemska, Address: Vienna, Austria
Identifiers: aluminum partially oxidized surface, Auger oxidized aluminum, mass spectroscopy oxidized aluminum
CAS Registry Numbers: 7429-90-5

CA088120796073
SIMS study of adsorption on nickel (110), (100) and (111)
Authors: Barbier, M., Bordoli, R. S., Vickerman, J. C., Woltemhorne, J.
Section: CA060003, CA067XX
Publ. Class: CONF PROD
Publ: 77 Series: 2 Pages: 993-96
Publisher: W. Dobrozemska, Address: Vienna, Austria
Identifiers: nickel adsorption mass spectroscopy, secondary ion mass spectroscopy adsorption

CA088120796078
Desc: Mass spectrocscopy, secondary-ion mass spectrocscopy, secondary ion mass spectrocscopy adsorption
Identifiers: reactions photolization spectrum acetaldenide produced
CAS Registry Numbers: 75-07-0

CA08812079650U
A comparison of the adsorption of oxygen and carbon monoxide on molybdenum using low-energy SIMS and EID
Authors: Dasson, P. H.
Section: CA060003, CA067XX
Publ. Class: CONF PROD
Publ: 77 Series: 2 Pages: 895-8
Publisher: W. Dobrozemska, Address: Vienna, Austria
Identifiers: adsorption oxygen carbon monoxide molybdenum, secondary ion mass spectroscopy adsorption, desorption oxygen carbon monoxide molybdenum
An investigation of thin insulating films using SIMS analysis

Authors: Litovchenko, V. G.; Komleva, G. P.; Marchenko, R. I.

Location: Inst. Semicond., Kiev, USSR


Descriptors: Mass spectra, secondary-ion; interface; surface structure; properties; silicon-silica film; amorphous silicon-silica, annealing silicon-silica film

CAS Registry Numbers: 7631-86-9 7440-21-3

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Ion imaging in secondary ion mass spectrometry

Authors: Newbury, Dale E.


Descriptors: Mass spectroscopy, secondary-ion; imaging

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Molecular beam epitaxy of gallium arsenide and simultaneous characterization by RHEDD, SIMS, and AES techniques

Authors: Plung, R.; Fischer, A.; Raisch, F.

Location: Max-Planck-Instit. Festkoerperforsch., Stuttgart, Germany


Descriptors: Molecular beam, epitaxy; gallium arsenide; epitaxy; simultaneous characterization; tin doped arsenide epitaxy characterization

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Electron emission spectroscopy, Auger, Mass spectroscopy, ion; Electron beam, chemical and physical effects

Authors: Dijkstra, H.

Location: CEN, CEA, Saclay, France


Descriptors: Electron emission spectroscopy; Auger; Mass spectroscopy; ion; Electron beam, chemical and physical effects; Electron emission spectroscopy; secondary; properties; Auger spectra; study damage; induced; studies; interactions; materials

CAS Registry Numbers: 7631-86-9 7440-27-5
CA088120830P08
Identifiers: analysis ion probe; secondary ion mass spectroscopy; uranium
CAS Registry Numbers: 7440-61-1 7429-90-5 7440-21-3
7440-47-3 7439-95-5 7439-39-6 7440-52-0 7440-48-4 7440-50-8
7440-67-7 7439-98-7

CA088120830P30
A computer-based recording system for high mass-resolution
ion-probe analysis
Authors: Long, J. V. P.; Astill, D. M.; Coles, J. M.; Reed, S. J. B.
Location: Ion Probe Unit, Natl. Environ. Res. Council,
Cambridge, Engl.
Section: CA079002 Pub Class: JOURNAL
PSCAD Publ: 77 Series: 12 Issue: Int. Conf. X-Ray
Pages: 132A-132C
Identifiers: computerized recording ion probe analysis, magnetic field control ion probe

CA088120830P30
Identifiers: Mass spectrometers and spectrographs, secondary-
ion, probe; Recording apparatus, Computer application
Identifiers: based system anal high resoln system

CA0881208268TH
SIMS and electron microscopy study of the transition layer for a silicon deposited on a sapphire substrate
Authors: Trilhe, J. J.; Blanchard, B.; Bonel, J.
Section: CA075013 Pub Class: CONF PROC
Publ: 77 Series: 1 Issue: 541-4
Publisher: R. Dobrozenski; Address: Vienna, Austria
Avail: Dobrozenski, R.; Ruedenauer, P.; Wielbock, F. P
Identifiers: silicon sapphire transition layer

CA0881208268TH
Identifiers: Interface
Identifiers: properties sapphire electron microscopic study
Silicon
CAS Registry Numbers: 7440-21-3 1317-82-4

54

CA088140981088

Quantitative SIMS - analysis on nonplanar surfaces
Author: Ruedena R., F. G., Steiger, M.
Location: Sied., Vienna, Austria
Section: CA076011, CA0685XX Publ Class: CONF PROC
Publ: 77 Pages: 3 Pages: 2535-8
Publisher: R. Dobrozensky Address: Vienna, Austria
Avail: Dobrozensky, R.; Ruedena R.; Viehbeck, F.
Identifiers: surface analysis mass spectroscopy, secondary ion mass spectroscopy, quant surface analysis

CA088140981089

Descriptive: Mass spectroscopy, secondary-ion, quant.
Identifiers: surface analysis spectroscopy

CA088140981090

Tridimensional characterization of solid surfaces with SIMS analysis
Author: Diebold, A., Marguerite, J. L.
Section: CA076011 Publ Class: CONF PROC
Publ: 77 Series: 3 Pages: 2523-5
Publisher: R. Dobrozensky Address: Vienna, Austria
Avail: Dobrozensky, R.; Ruedena R.; Viehbeck, F.
Identifiers: review secondary ion mass spectroscopy

CA088140981091

Descriptive: Mass spectroscopy, secondary-ion:Surface
Identifiers: three dimensional characterization solid surfaces spectroscopy

CA088140981092

Kinetic studies on single crystals of fluorides and oxides
By SIMS and AES
Author: Bilu, R., Pringsine, A.
Location: Balzers A-G, Hochvakuum Techn. Duenne Schichten, Balzers, Liechtenstein
Section: CA067003, CA0686XX, CA076XXX Publ Class: CONF PROC
Publ: 77 Series: 2 Pages: 1039-42
Publisher: R. Dobrozensky Address: Vienna, Austria
Avail: Dobrozensky, R.; Ruedena R.; Viehbeck, F.
Identifiers: electron beam reaction fluoride oxide electron beam, oxide surface reaction electron beam, mass spectroscopy fluoride oxide electron, Auger fluoride oxide electron, color center fluoride oxide electron

CA088140981093

Descriptive: Kinetics, reaction: fluorides, reactions: Oxides, reaction: mass spectroscopy, secondary-ion: Electron emission spectroscopy, Auger: Electron beam, chemical and physical effects
Identifiers: surface beams surfaces study formation
CAS Registry Numbers: 7783-40-6 7789-75-5 7631-85-5 471-34-1

CA088140981094

Recall spectroscopy of oxygen on tungsten(100)
Author: Prigge, S., Niethaus, H., Bauer, E.
Section: CA066003, CA076XXX Publ Class: CONF PROC
Publ: 77 Series: 2 Pages: 1381-4
Publisher: R. Dobrozensky Address: Vienna, Austria
Avail: Dobrozensky, R.; Ruedena R.; Viehbeck, F.
Identifiers: oxygen adsorbed tungsten recall spectroscopy, mass spectroscopy ion recall adsorbate

CA088140981095

Descriptive: Mass spectroscopy, secondary-ion:Adsorbed substances
Identifiers: properties tungsten recall oxygen ions study
CAS Registry Numbers: 7782-44-7 7440-33-7 7782-44-70

CA088140981096

A unique instrument for multiple technique surface characterization by ESCA, scanning Auger, UPS and SIMS
Author: Palmberg, F. W., Biggs, W. M.
Section: CA066003, CA073XXX, CA076XXX Publ Class: CONF PROC
Publ: 77 Series: 3 Pages: 2617-20
Publisher: R. Dobrozensky Address: Vienna, Austria
Avail: Dobrozensky, R.; Ruedena R.; Viehbeck, F.
Identifiers: Auger surface study app., photoelectron spectroscopy surface study app., mass spectroscopy surface study app., electron scanning microscopy surface, surface study combined spectroscopy

CA088140981097

Descriptive: Electron emission spectroscopy, Auger, Photoelectron spectroscopy, Auger, Photoelectron spectroscopy, Auger, Photoelectron spectroscopy, Auger, Photoelectron spectroscopy, UV
Identifiers: combined other techniques Auger multiple study
CA0861611004B

Application of SIMS analysis with reactive sputtering and conclusions to the mechanism of the secondary ionization
Author: Giber, V., Jozsefolya, V. M.
Section: CA076005 Publ Class: CONF PROC
Publ: 77 Series: 3 Pages: 2585-8
Publisher: R. Dobrozensky Address: Vienna, Austria
Availability: Dobrozensky, R.; Ruedenauer, F.; Vienboeck, F. P
Identifiers: secondary ionization mass spectroscopy, argon ionization mass spectroscopy, sputtering reactive mass spectroscopy, aluminum alloy secondary ionization, magnesium alloy secondary ionization, silicon alloy secondary ionization, copper alloy secondary ionization, nickel alloy secondary ionization
CAS Registry Numbers: 7782-44-7 7440-37-1 11099-20-0 11099-22-2 11099-19-7 11114-68-4 11148-32-6

CA0861611004B

Preferential sputtering on binary alloys by SIMS
Author: Arita, M., Somono, M.
Location: Dep. Metall. Eng., Tokyo Inst. Technol., Tokyo, Japan
Section: CA076005 Publ Class: CONF PROC
Publ: 77 Series: 3 Pages: 2511-14
Publisher: R. Dobrozensky Address: Vienna, Austria
Availability: Dobrozensky, R.; Ruedenauer, F.; Vienboeck, F. P
Identifiers: preferential sputtering binary alloy, deuterium sputtering vanadium niobium
CAS Registry Numbers: 7782-39-0 7440-32-2 7440-03-1

CA08616110025

The SIMS spectrum of the oxygen-tungsten (100) chemisorption system
Author: Yu, Ming L
Location: Brookhaven Natl. Lab., Upton, N. Y.
Section: CA066003, CA07600X Publ Class: UJOURNAL
Chemical isotope effect: Chemisorption; Mass spectrometry
Secondary ion mass spectrometry
Isotope effect: Analyses tungsten study oxygen tungsten
CAS Registry Numbers: 7782-34-7 7782-39-0 14797-71-8

The use of nuclear reactions and SIMS for quantitative depth profiling of hydrogen in amorphous silicon
Section: CA0816114750
Coden: APPLAB
Publ: 77 Seres: 31 Issue: 9 Pages: 562-5
Identifiers: Hydrogen profile detn silicon, amorphous silicon analysis hydrogen, radiochem hydrogen profile detn silicon, secondary ion mass spectrometry hydrogen, mass spectrometry hydrogen detn silicon

Analysis of depth profile amorphous silicon
nuclear reactions secondary ion mass spectrometry hydrogen
CAS Registry Numbers: 1333-74-0 7440-21-3

Determination of rare-earth oxides using an ion microprobe
Author: Uchino, Yoshinori, Ishizuka, Yoshio, Nakajina, Kunio, Sunahara, Hiroshi
Location: Univ. Ind. Res. Inst., Nagoya, Japan
Section: CA0816114745
Publ: 77 Series: 25 Issue: 2 Pages: 153-15 Language: Japan
Identifiers: Lanthane oxide detn ion microprobe, mass spectrometry lanthane oxide detn, yttrium oxide detn ion microprobe, lanthanum oxide detn ion microprobe, cerium oxide detn ion microprobe, praseodymium oxide detn ion microprobe, neodymium oxide detn ion microprobe, samarium oxide detn ion microprobe

Rare earth oxides; Mass spectrometry, secondary ion microprobe
Identifiers: Analyses detn
CA068220145567Y
Secondary ion mass spectrometry of deuterium in titanium, zirconium, vanadium, nickel, and tantalum
Authors: Inoue, N.; Kobayashi, Y.; Saito, H.
Location: Dep. Metall., Tokyo Inst. Technol., Tokyo, Japan
Publisher: R. Doohranovsky, Address: Vienna, Austria
Availability: Doktorsky, R.; Nuernberger, F.; Vignoecz, F. P.
Identifiers: Deuterium data mass spectrometry, secondary ion mass spectrometry deuterium, titanium analysis deuterium, zirconium analysis deuterium, vanadium analysis deuterium, nickel analysis deuterium, tantalum analysis deuterium, alloy analysis deuterium, iron titanium alloy analysis deuterium, aluminum titanium alloy analysis deuterium

CA06822014567Y
Identifiers: analysis data secondary ion mass spectrometry deuterium base

CA0682201454844
Ion microprobe using a field evaporation ion source fed by liquid gallium
Authors: Inoue, G. R., Krith, V. E.
Location: U.S.A.
Citation: Energy Res. Abstr. 1978, 311, Abstr. No. 3143
Availability: NIFS
Identifiers: ion microprobe field evaporation source, gallium field evaporation ion source

CA0682201454844
Identifiers: ion sources, field-evap.: Mass spectrometers and spectrographs, secondary-ion, microprobe
Identifiers: uses miscellaneous ion analysis gallium fed high-resin scanning efficiency collection region
CAS Registry numbers: 7460-59-3

CA0682201450380
Interface studies of metal-semiconductor contacts by means of SIMS, nuclear reaction and RBS
Authors: Ponge, J. P.; Grob, J. J.; Grob, A.; Stuck, R.; Siffert, P.
Section: CA076013 Publ. Class: JOURNAL

CA0682201450990
Identifiers: Interface
Identifiers: properties accumulation gold silicon interfaces oxygen
CAS Registry numbers: 7782-44-7 7440-57-5 7440-21-3

CA0682201446894
Energy analyzed secondary ion mass spectrometry and simultaneous Auger and XPS measurements of ion bombarded surfaces
Authors: Knuss, A. R., Gruen, D. M.
Section: CA076004 Publ. Class: JOURNAL
Identifiers: Secondary ion sputtering, kinetic energy sputtered ion, emission secondary ion sputtering, potassium secondary ion sputtering, aluminum secondary ion sputtering, titanium secondary ion sputtering, argon sputtering metal, surface oxygen metal sputtering

CA0682201446118
Hydrogen ion implantation profiles as determined by SIMS
Authors: Magee, Charles M., Wu, Chung P.
Location: RCA Lab., Princeton, N. J.
Section: CA076002, CA076044, CA076068 Publ. Class: JOURNAL
Identifiers: mass spectrometry hydrogen implantation, silicon implantation hydrogen, stopping power hydrogen silicon

CA0682201446118
Identifiers: mass spectrometry, secondary ion
Identifiers: properties implantation profile silicon oxygen hydrogen
CAS Registry numbers: 1333-74-0 7440-21-3
Quantitative analysis of oxygen in thin epitaxial layers of gallium arsenide by SIMS

Author: Huber, A. W., Morillo, G., Linn, N. T., Deboer, J. L., Vaillancourt, M.
Section: CA970068 Pub. Class: JOURNAL
Identifiers: oxygen, epitaxial gallium arsenide, secondary ion mass spectrometry, oxygen, epitaxial gallium arsenide analysis oxygen

Analysis: oxygen, epitaxial gallium arsenide mass spectrometry of gallium arsenide
CAS Registry Numbers: 2795-44-7

Secondary ion mass spectrometry of rare earth elements
Author: Ishtuku, Takashi, Uwamino, Yoshimori, Nakajima, Kunio, Sunahara, Hiroshi
Location: Gov. Ind. Res. Inst., Nagoya, Japan
Section: CA970001 Pub. Class: JOURNAL
Language: Japanese
Identifiers: secondary ion mass spectrometry, mass spectrometry, rare earth metal, rare earth compound, metal spectrometry

Analysis: mass spectrometry, rare earth element, rare earth compound, mass spectrometry
CAS Registry Numbers: 2795-44-7

Study of contamination of copper surfaces with abrasive materials by low energy secondary ion mass spectrometry
Author: Saw, Yoshiki, Kikuchi, Tadashi, Funuy, Koichi
Location: Fac. Sci., Sci. Univ. Tokyo, Tokyo, Japan
Section: CA970011, CA968820 Pub. Class: JOURNAL
Identifiers: mass spectrometry, copper surface, abrasive polishing, copper surface

Analysis: mass spectrometry, secondary ion, low energy, polishing, abrasive, properties, surfaces, spectroscopic study, studies copper
CAS Registry Numbers: 7440-59-8
Secondary ion mass spectrometry of surfaces at low energies

Identification: mass spectrometry secondary ion blot, amino acid mass spectrometry, peptide mass spectrometry, pharmaceutical mass spectrometry, vitamin mass spectrometry, surfonamide mass spectrometry.

Description: SIMS low energy surface adsorption, mass spectrometry secondary ion surface, spectrometer secondary ion quadrupole filter, high sensitivity SIMS spectrometer, oxygen adsorption metal SIMS, copper adsorption oxygen SIMS, aluminum adsorption oxygen SIMS, titanium adsorption oxygen SIMS, carbon dioxide adsorption magnesium aluminum.

Identification: properties aluminum magnesium alloy study oxygen metals nonbas carbon dioxide spectrometry studies low energies surfaces relation.


A comparison of Auger electron spectroscopy (AES) and secondary ion mass spectrometry (SIMS)

Identification: semiconductor material analysis mass spectrometry, Group III V semiconductor analysis, secondary ion mass spectrometry, ion microrobe mass spectrometry.

Description: Group IIIA element pnictides; Mass spectrometry; Secondary ion; Group III V materials.

Identification: anal Group III V
CA098080703270
X-ray microanalysis and secondary ion mass spectrometry on
thin films of different thicknesses. Combined quantitative
utilization
Author: Bresse, J. F., Manfaitier, J. C.
Montpellier, Fr.
Section: CA079006 Publ Class: JOURNAL
Journal: Vide Codoni: VIDEA Publ: 78 Series: 189
Issue: Sub-1. Pages: 73-9 Language: Fr
Identifiers: thin film analysis, secondary ion mass
spectroscopy film, mass spectroscopy film analysis, electron
microprobe film analysis, X-ray analysis film
CA098080703270
Descriptors: Electron microprobe analysis: Films; Mass
spectroscopy, secondary-ion
Identifiers: Thin

CA09808070323U
Secondary ion mass spectrometry and Auger electron
spectroscopy semiquantitative analysis of metal alloys
Author: Davis, L. E., Genlach, R. L.
Prairie, Minn.
Section: CA079006 Publ Class: TECH REP
Meeting Date: 77
Identifiers: alloy analysis Auger mass spectroscopy, Auger
spectroscopy alloy analysis, mass spectroscopy alloy analysis,
secondary ion mass spectroscopy alloy
CA09808070323U
Descriptors: Alloys, analysis: Electron emission spectroscopy-
-Auger, Mass spectroscopy, secondary-ion
Identifiers: Auger semiquant

CA09808070321S
Quantitative analysis by secondary ion mass spectrometry
Author: Newbury, D. E.
D. C.
Section: CA079006 Publ Class: TECH REP
Meeting Date: 77
Identifiers: secondary ion mass spectrometry analysis, Quant
analysis mass spectroscopy, multichannel analysis mass
spectroscopy, glass analysis mass spectroscopy, local thermal
equilibrium mass spectroscopy, sensitivity factor mass spectroscopy

CA09808070321S
Descriptors: Mass spectroscopy, secondary-ion
Identifiers: Quant multielement anal comparison accuracy
local thermal equil model sensitivity factors

CA0980807021A
Quantitative analysis of phosphorus and arsenic in silicon
by ion microanalyzer
Author: Tsuchiya, Hitoshi, Hashimoto, Norikazu
Location: Hitachi Cent. Res. Lab., Kokubunji, Japan
Section: CA079006 Publ Class: JOURNAL
Journal: Shitsuryo Bunseki Codeni: SHIMAK Publ: 77
Series: 25 Issue: 4 Pages: 351-62 Language: Japan
Identifiers: arsenic detm ion microanalyzer, phosphorus detn
ion microanalyzer, Ion microanalyzer arsenic phosphorus detn.
silicon analysis arsenic phosphorus, phosphosilicate glass
analysis phosphorus, secondary ion mass spectrometry

CA0980807021A
Descriptors: Glass, oxide
Identifiers: analysis arsenic phosphorus detn ion microprobe
silicon phosphosilicate
CAS Registry Numbers: 7440-21-3 7440-38-2 7723-14-0

CA09808069261R
Possibility of using the secondary ion mass spectrometry
t method to study super-thin silica layers
Author: Didenko, P. I., Marchenko, R. I., Romanova, G. F.
Location: USSR
Section: CA079003 Publ Class: CONF PROC
Language: Russian
Publisher: "Naukova Dumka" Address: Kiev, USSR
Avail: Sveschnikov, S. V
Identifiers: silica film mass spectrometry

CA09808069261R
Descriptors: Mass spectrometry, secondary-ion
Identifiers: Uses miscellaneous films study super-thin silica
layers
CAS Registry Numbers: 7631-86-9
CA08912099159F
Semi-quantitative analyses by secondary ion mass spectrometry using one fitting parameter
Author: Morgan, A. E., Wagner, H. M.
Location: Philips Res. Lab., Eindhoven, Neth.
Identifiers: single fitting parameter, mass spectrometry, correlation secondary ion mass spectrometry, metal analysis mass spectrometry correction, mineral analysis mass spectrometry correction

CA089120998581A
Depth profiling of sodium in silicon dioxide films by secondary ion mass spectrometry
Author: Magee, Charles W., Harrington, William L.
Location: RCA Lab., Princeton, N. J.
Identifiers: sodium implant profile, silica, mass spectrometry, sodium silica

CA089120998581A
Identifiers: properties depth profile silica films implanted profiling ion sodium secondary mass spectrometry
CAS Registry Numbers: 7440-23-5 7631-86-9

CA08912099801F
A study of conversion coating development on aluminum in chromate/fluoride solutions using secondary ion mass spectrometry
Author: Abd Rabbo, M. F., Richardson, J. A., Wood, G. C.
Identifiers: aluminum conversion coating, mass spectrometry
CA90020012740N
Secondary ion mass spectrometry and Auger electron spectroscopy investigations of V metal foils prepared for hydrogen permeation measurements
Author: Boes, N., Zuechner, H.
Section: CA906002
Publ Class: JOURNAL
Coden: SUTEDE
Publ: 78
Series: 7
Issue: 5
Pages: 401-11
Identifiers: Hydrogen permeation V metal foil, vanadium foil, tantalum foil, hydrogen, neon, helium, argon, carbon, oxygen, carbon monoxide, tantalum, vanadium, carbon monoxide, cleaning, relation, Hydrogen spectroscopy, Auger study, uses, miscellaneous films, Group V, use of CAS Registry Numbers: 1333-74-0, 7440-03-1, 7440-05-3
CA909262358738
The gas ion probe: a novel instrument for analyzing concentration profiles of gases in solids
Author: Riedel, M., Menadovic, T., Perovic, B.
Location: Max-Planck-Instit. Kernphys., Heidelberg, Ger.
Section: CA909006
Publ Class: TECH REP
Journal: Report
Coden: DZREP
Publ: 77
Issue: 5
Pages: 10
Citation: INIS Atomindex 1978, 91(17), Abstr. No. 394143
Available: INIS
Identifiers: Lunar sample analysis, rare gas, rare gas profile ion microprobe, secondary ion mass spectrometry, helium profile in lunar sample, neon profile in lunar sample
CA909262255738
Descriptive: Helium-group gases, analysis, mass spectrometers and spectrographs, secondary-ion mass spectrometry, secondary-ion, Moons, solids
Identifiers: Drift profile, lunar samples, probe, thermalizing, box, rare materials
CAS Registry Numbers: 7440-01-9, 7440-59-7
CA90926224648J
SIMS study of iron-nickel and iron-chromium alloys. III. Dependence of emission of atomic clusters on alloy composition
Author: Riedel, M., Menadovic, T., Perovic, B.