AD-A019 507

INVERSE MEAN FREE PATH, STOPPING POWER, CSDA RANGE, AND STRAGGLING IN ALUMINUM AND ALUMINUM OXIDE FOR ELECTRONS OF ENERGY = OR < 10 keV

J. C. Ashley, et al

Oak Ridge National Laboratory

Prepared for:

Air Force Cambridge Research Laboratories
Energy Research and Development Administration

December 1975

DISTRIBUTED BY:

NTIS
National Technical Information Service
U. S. DEPARTMENT OF COMMERCE

023092

INVERSE MEAN FREE PATH, STOPPING POWER, CSDA RANGE, AND STRAGGLING IN ALUMINUM AND ALUMINUM OXIDE FOR ELECTRONS OF ENERGY < 10 keV

J. C. Ashley
C. J. Tung
V. E. Anderson
R. H. Ritchie

Oak Ridge National Laboratory
Oak Ridge, Tennessee 37830

December 1975

Scientific Report No. 1

DDC
RECEIVED
JAN 20 1976
C

Approved for public release; distribution unlimited.

This research was sponsored by the Defense Nuclear Agency under Subtask Z99QAXTA040, Work Unit 51, entitled "Secondary Electron Transport Phenomenology" and in part by the Energy Research and Development Administration under contract with Union Carbide Corp.

AIR FORCE CAMBRIDGE RESEARCH LABORATORIES
AIR FORCE SYSTEMS COMMAND
UNITED STATES AIR FORCE
HANSCOM AFB, MASSACHUSETTS 01731

Reproduced by
NATIONAL TECHNICAL
INFORMATION SERVICE
US Department of Commerce
Springfield, VA. 22151

REPRODUCED FROM
BEST AVAILABLE COPY

Unclassified

SECURITY CLASSIFICATION OF THIS PAGE (When Data Entered)

REPORT DOCUMENTATION PAGE		READ INSTRUCTIONS BEFORE COMPLETING FORM
1. REPORT NUMBER AFCRL-TR-75-0583	2. GOVT ACCESSION NO.	3. RECIPIENT'S CATALOG NUMBER
4. TITLE (and Subtitle) INVERSE MEAN FREE PATH, STOPPING POWER, CSDA RANGE, AND STRAGGLING IN ALUMINUM AND ALUMINUM OXIDE FOR ELECTRONS OF ENERGY ≤ 10 keV		5. TYPE OF REPORT & PERIOD COVERED Scientific - Interim 6. PERFORMING ORG. REPORT NUMBER Scientific Report No. 1
7. AUTHOR(s) J. C. Ashley R. H. Ritchie C. J. Tung V. E. Anderson		8. CONTRACT OR GRANT NUMBER(s) Y75-886
9. PERFORMING ORGANIZATION NAME AND ADDRESS Oak Ridge National Laboratory Oak Ridge, Tennessee 37830		10. PROGRAM ELEMENT, PROJECT, TASK AREA & WORK UNIT NUMBERS 62704H CDNA0008
11. CONTROLLING OFFICE NAME AND ADDRESS Air Force Cambridge Research Laboratories Hanscom AFB, Massachusetts 01731 Contract Monitor: Dr. John N. Bradford/LQR		12. REPORT DATE December 1975 13. NUMBER OF PAGES 54
14. MONITORING AGENCY NAME & ADDRESS(if different from Controlling Office)		15. SECURITY CLASS. (of this report) Unclassified 15a. DECLASSIFICATION/DOWNGRADING SCHEDULE

16. DISTRIBUTION STATEMENT (of this Report)

Approved for public release; distribution unlimited.

17. DISTRIBUTION STATEMENT (of the abstract entered in Block 20, if different from Report)

18. SUPPLEMENTARY NOTES

This research was sponsored by the Defense Nuclear Agency under Subtask Z99QAXTA040, Work Unit 51, entitled "Secondary Electron Transport Phenomenology and in part by the Energy Research and Development Administration under contract with Union Carbide Corp.

19. KEY WORDS (Continue on reverse side if necessary and identify by block number)

electron transport
energy loss
theory

20. ABSTRACT (Continue on reverse side if necessary and identify by block number)

The interaction of electrons with the solids Al and Al_2O_3 is described based on the electron gas model for the conduction band electrons in Al, a model insulator theory for the valence electrons in Al_2O_3, and inner shell ionization derived from atomic, generalized oscillator strengths. Contributions to the inverse mean free path and stopping power from the various interaction processes are tabulated for electron energies from 0.5 eV to 10 keV for Al and from 10 eV to 10 keV for Al_2O_3.

DD FORM 1 JAN 73 1473 EDITION OF 1 NOV 65 IS OBSOLETE

Unclassified

SECURITY CLASSIFICATION OF THIS PAGE (When Data Entered)

Block 20. (Continued)

Electron range in the continuous-slowing-down approximation and straggling are tabulated for electron energies from 10 eV to 10 keV for both materials.

A

CONTENTS

I. INTRODUCTION 4

II. GENERAL FORMULATIONS. 5

III. DIMFP'S (DIFFERENTIAL INVERSE MEAN FREE PATHS) FOR THE ALUMINUM CONDUCTION BAND 7

IV. DIMFP'S FOR INNER SHELLS 10

V. DIMFP'S FOR VALENCE ELECTRONS IN Al_2O_3. 12

VI. EXCHANGE CORRECTED DIMFP'S AND FORMULAE FOR THE TABULATIONS. 14

VII. REFERENCES 18

VIII. ALUMINUM: EXPLANATION OF TABLES 20

TABLE 1A - INVERSE MEAN FREE PATH OF ELECTRONS IN ALUMINUM 22

TABLE 1B - STOPPING POWER OF ALUMINUM FOR ELECTRONS ... 27

TABLE 1C - CSDA RANGES AND STRAGGLING OF ELECTRONS IN ALUMINUM 32

IX. ALUMINUM OXIDE: EXPLANATION OF TABLES. 37

TABLE 2A - INVERSE MEAN FREE PATH OF ELECTRONS IN Al_2O_3.. 39

TABLE 2B - STOPPING POWER OF Al_2O_3 FOR ELECTRONS. 44

TABLE 2C - CSDA RANGE AND STRAGGLING OF ELECTRONS IN Al_2O_3. 49

I. INTRODUCTION

A quantitative description of the interaction of electrons with matter over a large range of energies is a subject of basic importance in a wide variety of theoretical and applied areas. From the theoretical standpoint, calculations of energy loss and range of electrons in many different materials have formed the basis of at least two extensive tabulations.[1,2] Both of these works are restricted to electron energies ≥ 10 keV and are based on the Bethe theory of stopping power including various modifications and corrections (e.g. density-effect corrections). We feel that similar tabulations for electron energies < 10 keV, based on a priori calculations using currently available theoretical information, will provide useful guides for interpretation of experimental data as well as input for calculations in applied areas.

Our work here will involve model calculations to describe the extended electron states of a solid (valence band or conduction band). The more tightly bound, inner shells of the atoms in the solid will be assumed to be essentially unchanged in character from those in free atoms. Thus, excitation of electrons from the inner shells will be based on calculations of atomic, generalized oscillator strengths (GOS's). More specifically, the differential inverse mean free path (DIMFP), which forms the basic function required in our work, will be derived from an electron gas model describing the conduction band electrons in Al and from a model insulator theory applied to the valence band in Al_2O_3. The DIMFP's for electron interaction with the inner shells of the Al and O atoms

are calculated from a priori atomic GOS calculations for exciting electrons to the continuum from the 2s and 2p sub-shells of Al[3] and the K shell of O.[4] The DIMFP for removing an electron from the K shell of Al is obtained from GOS values based on hydrogenic wavefunctions.[5] Given the DIMFP's associated with the most important electron interaction processes in the solids we then calculate inverse mean free paths, stopping powers, csda ranges, and range and energy straggling for electron energies from a few eV to 10 keV.

The details of the components of our calculations are described more fully in the next four sections. In section VI exchange corrections are discussed, expressions given for the exchange corrected DIMFP's, and formulas used in these tabulations are displayed.

II. GENERAL FORMULATIONS

A charged particle passing through a solid interacts with a large number of electrons simultaneously and it is thus appropriate to speak of a mean free path of the charged particle against energy loss to the solid. Assuming the effect of the charged particle on the medium may be treated in first Born approximation, the inverse mean free path, differential in momentum transfer, $\hbar\vec{k}$, and energy transfer, $\hbar\omega$, for a particle of velocity v is given by

$$\frac{d^2\mu}{dk\,d\omega} = \frac{2e^2}{\pi\hbar v^2}\,\frac{1}{k}\,\mathrm{Im}\left[\frac{-1}{\epsilon(k,\omega)}\right] \tag{1}$$

where $\epsilon(k,\omega)$ is the exact dielectric function of the solid.[6,7] We assume in this work that the solid is isotropic and homogeneous.

For our calculations of inverse mean free path, stopping power, etc., it is sufficient to compute inverse mean free paths differential in energy transfer only. This differential inverse mean free path (DIMFP) for energy loss $\hbar\omega$ by an electron with energy $E = mv^2/2$ in the solid is given by

$$\tau(E,\hbar\omega) \equiv \frac{d\mu}{d(\hbar\omega)} = \frac{1}{\pi a_o E}\int_{k_-}^{k_+} \frac{dk}{k}\ \mathrm{Im}\left[\frac{-1}{\epsilon(k,\omega)}\right] \tag{2}$$

where $\hbar k_{\pm} \equiv \sqrt{2m}\left[\sqrt{E} \pm \sqrt{E-\hbar\omega}\right]$ and $a_o \equiv \hbar^2/me^2$. This expression assumes that the energy-momentum relation for a swift electron in the solid does not differ appreciably from that of a free electron in vacuum.

Given $\epsilon(k,\omega)$ for the solid, the quantities of interest here follow directly from $\tau(E,\hbar\omega)$. The inverse mean free path of the electron, μ, is given by integrating over allowed energy transfers as

$$\mu(E) = \int d(\hbar\omega)\ \tau(E,\hbar\omega)\ . \tag{3}$$

The rate of energy loss of the electron, or the stopping power of the medium, is given by

$$S(E) \equiv -dE/dx = \int d(\hbar\omega)\ \hbar\omega\ \tau(E,\hbar\omega)\ ,$$

and the mean square energy loss per unit path length by

$$\Omega^2(E) = \int d(\hbar\omega)(\hbar\omega)^2\ \tau(E,\hbar\omega)\ . \tag{5}$$

With these results we may calculate the range of an electron in the continuous-slowing-down approximation (csda range) by

$$R_o(E) = \int_{E_o}^{E} dE'/S(E') \quad . \tag{6}$$

The lower limit on this integration will be discussed further in Section VI. The mean square fluctuation in the range or "range straggling" will be calculated from Eq. (3) and Eq. (4) as[8]

$$(R - R_o)^2_{AV} \equiv \int_{E_o}^{E} dE' \, \Omega^2(E')/[S(E')]^3 \quad . \tag{7}$$

In practice, the DIMFP will be evaluated as a sum of contributions from various distinct processes. For example we calculate a DIMFP for removing an electron from a given inner shell, a DIMFP for plasmon excitation, etc. The total DIMFP used to describe the interaction of an electron with the given solid will be given by

$$\tau(E,\omega) = \sum_i \tau_i(E,\omega) \tag{8}$$

where the sum over i adds the contributions from the various interaction processes. The evaluation of the τ_i's for Al and Al_2O_3 is described in the next three sections.

III. DIMFP's FOR THE ALUMINUM CONDUCTION BAND

The conduction band of Al will be described by an electron gas model. The dielectric response function in the form given by Lindhard[6] is

$$\epsilon(k,\omega) = 1 + (\chi^2/z^2)\,[f_1(x,z) + if_2(x,z)] \tag{9}$$

in terms of the dimensionless variables $x = \hbar\omega/E_F$ and $z = k/2k_F$ with E_F the Fermi energy and k_F the Fermi wavenumber of the electron gas. Also, $\chi^2 \equiv e^2/\pi\hbar v_F$ where v_F is the Fermi velocity. The function f_1 is given by

$$f_1(x,z) = \tfrac{1}{2} + \frac{1}{8z}\left[1-(z-x/4z)^2\right]\ln\left|\frac{z-x/4z+1}{z-x/4z-1}\right| + \frac{1}{8z}\left[1-(z+x/4z)^2\right]\ln\left|\frac{z+x/4z+1}{z+x/4z-1}\right| . \tag{10a}$$

The function f_2 is defined by

$$f_2(x,z) = \begin{cases} \pi x/8z\,, & \text{for } z+x/4z < 1 \\ \frac{\pi}{8z}\left[1-(z-x/4z)^2\right], & \text{for } |z-x/4z| < 1 < z+x/4z \\ 0\,, & \text{for } |z-x/4z| > 1 \end{cases} . \tag{10b}$$

From Eq. (2), the DIMFP is given by

$$\tau(E,\hbar\omega) = \frac{\chi^2}{\pi a_o E}\int_{z_-}^{z_+} dz\,\frac{z f_2}{(z^2+\chi^2 f_1)^2+(\chi^2 f_2)^2} \tag{11}$$

where $z_\pm \equiv k_\pm/2k_F$. Energy losses of an incident electron to an electron gas may be divided into: (a) losses resulting from excitation of single electrons out of the Fermi sea and (b) losses to collective oscillations of the electron gas (plasmon excitation). The contribution to the total DIMFP due to (a) is identified with the region in which f_2 is non-zero. This electron-electron term is written as

$$\frac{d\mu_{ee}}{dx} \equiv \tau_{ee}(\varepsilon,x) = \frac{\chi^2\,\theta(\varepsilon-x)}{\pi a_o(\varepsilon+1)}\int_{\frac{1}{2}(\sqrt{x+1}-1)}^{\frac{1}{2}(\sqrt{x+1}+1)} dz\,\frac{z f_2}{(z^2+\chi^2 f_1)^2+(\chi^2 f_2)^2} \tag{12}$$

where ϵ is the incident electron energy measured from the Fermi level in units of the Fermi energy, i.e., $\epsilon = (E - E_F)/E_F$, and the step function $\theta(\epsilon - x)$ restricts the incident electron to states above the Fermi level.

The plasmon contribution arises from integration of Eq. (11) in the region where $f_2 \to 0$. The integral is zero except on the plasma resonance line defined by $z = z_o(x)$ through the equation

$$F(x, z_o) \equiv z_o^2 + \chi^2 f_1(x, z_o) = 0 . \tag{13}$$

The DIMFP for plasmon excitation is found to be

$$\tau_{pl}(\epsilon, x) = \frac{1}{a_o(\epsilon+1)} \frac{z_o}{|dF/dz|_{z = z_o}} \theta(x - x_{min}) \theta(x_{max} - x) \tag{14}$$

where x_{min} and x_{max} are the solutions of the equations

$$x_{min} = 4z_o(x_{min}) [\sqrt{\epsilon+1} - z_o(x_{min})] \tag{15}$$

and

$$x_{max} = 4z_o(x_{max}) [1 + z_o(x_{max})] . \tag{16}$$

For our later discussion of exchange corrections we need the DIMFP for creation of secondary electrons in this model. The results of Ref. (7) lead to

$$\tau_s(\epsilon, \epsilon') = \frac{\chi^2}{8a_o(\epsilon+1)} \int_{\epsilon'}^{\min(\epsilon'+1, \epsilon)} dx \int_{z_-}^{z_+} \frac{dz}{z^4 |\epsilon(2k_F z, E_F x)|^2} \tag{17}$$

where min(a,b) represents the smaller of the quantities a and b.

The use of this electron gas model, though based implicitly on the assumption of high electron densities, gives unexpectedly good results for real metal conduction band densities. In addition, Eq. (1) is derived in first Born approximation and would be expected to fail when the velocity of the incident electron approaches that of electrons in the electron gas. Lindhard,[6] however, points out that this equation may be reasonably good at any velocity since: (a) the relative velocity of the incident electron and representative electrons in the electron gas remains of the order of the Fermi velocity no matter how slowly the incident electron moves, and (b) at low velocities the Coulomb field of the incident electron is strongly screened by polarization in the electron gas so that for many purposes it can be considered small in the sense of perturbation theory.

IV. DIMFP'S FOR INNER SHELLS

From a general expression for the dielectric function of a homogeneous, isotropic system[9] we may show for values of ω which correspond to ionization of the ith inner shell in a solid that

$$\mathrm{Im}\left[\frac{-1}{\epsilon(k,\omega)}\right] \approx \mathrm{Im}\,\epsilon(k,\omega) \approx \frac{2\pi n_i e^2}{m\omega}\,\frac{df_i(k,\omega)}{d\omega} \tag{18}$$

where $df_i/d\omega$ is the generalized oscillator strength (GOS) for transitions from the ith independent inner shell. Here n_i is the number of ith inner shells per unit volume in the given solid. Equation (2) thus leads to

$$\tau_i(E,\hbar\omega) = \frac{8\pi a_o^2 n_i}{(E/R)(\hbar\omega/R)} \int_{k_-}^{k_+} \frac{dk}{k} \frac{df_i(k,\omega)}{d(\hbar\omega)} \tag{19}$$

where $\hbar\omega$ is the energy transfer and $R = e^2/2a_o$.

Generalized oscillator strengths for the ionization of L shell electrons in Al have been calculated by Manson[3] using a nonrelativistic Hartree-Slater central field model of the atom. These GOS values have been used as input for numerical evaluation of the integral over momentum transfer in Eq. (19) to obtain differential cross sections, $\tau_i/n_i = d\sigma_i/d(\hbar\omega)$, for the 2s and 2p subshells of Al. These cross sections when multiplied by the appropriate value of n_i give the DIMFP for the particular material. For example, τ_{2s}^{Al,Al_2O_3} would denote the DIMFP for removing a 2s electron from an Al atom with the density of Al atoms corresponding to that in Al_2O_3. This same type of notation will be used for contributions to the inverse mean free path and stopping power. The binding energy for 2s and 2p electrons in Al is taken to be 118.524 eV and 80.88 eV, respectively, for these calculations.

Similar calculations have been done for the 1s shell in oxygen. The values of the GOS for excitation to the continuum from the 1s shell of O were taken from the work of McGuire.[4] The binding energy of the 1s shell in O is taken to be 536.6 eV.

Our calculation of the DIMFP for excitation of electrons from the K shell of Al to the continuum is based on cross sections derived using hydrogenic wave functions. A detailed discussion of this type of cross section calcuation is

given in Ref. 5. We have used the equations in this reference to calculate the DIMFP based on a binding energy for the K shell in Al of 1545.8 eV and an "effective atomic number" of $Z_s = 12.5643$.

V. DIMFP'S FOR VALENCE ELECTRONS IN Al_2O_3

Since Al_2O_3 is a good insulator with a band gap of about 9 eV[10] it is desirable to represent the response of its valence electrons on the basis of a quite different model than that used for the conduction band in Al. The model which we have developed for this purpose is related to that employed by Fry[11] in which the ground state wave function of the valence electrons is described in the tight-binding approximation, while excited states are represented by orthogonalized plane waves (OPW). In our use of the model to obtain a dielectric response function we fix the normalization of the OPW excited states by requiring that the sum rule $\int_0^\infty d\omega\, \omega \mathrm{Im}[\epsilon(k,\omega)] = 2\pi^2 ne^2/m$, where n is the density of electrons in the valence band. In addition we assume that the solid is uniform and homogeneous. The dielectric response function corresponding to this model solid is convenient and flexible for use, can be fitted to the optical dielectric function in the limit of very long wavelengths ($k \to 0$), and describes the single-particle properties of excited electrons. The existence of plasma oscillations emerges naturally as one studies the response of the system to longitudinal electric perturbations.[12]

Since a detailed discussion of the insulator model is planned for publication[13] we quote here only the results needed for these calculations. The

result required here is the imaginary part of the dielectric response function for the model insulator given by

$$\mathrm{Im}\left[\epsilon(k,\omega)\right] = \pi n e^2 \Gamma / \hbar\beta k \Lambda \tag{20}$$

where

$$\Gamma \equiv \left\{ \frac{1}{3}\left[\frac{1}{\{\alpha^2+(k-p)^2\}^3} - \frac{1}{\{\alpha^2+(k+p)^2\}^3}\right] - \frac{32\alpha^4}{(\alpha^2+p^2)^2(4\alpha^2+k^2)^2}\left[\frac{1}{\alpha^2+(k-p)^2} - \frac{1}{\alpha^2+(k+p)^2}\right] + \frac{1024\,pk\,\alpha^8}{(\alpha^2+p^2)^4(4\alpha^2+k^2)^4}\right\} , \tag{21}$$

$$\Lambda \equiv \left[\omega_B + \frac{\hbar\beta}{m}(k^2+\alpha^2)\right]\left[\frac{1}{8\alpha^5} - \frac{32\alpha^3}{(4\alpha^2+k^2)^4}\right] \tag{22}$$

and

$$p = \left[m(\omega-\omega_B)/\hbar\beta\right]^{1/2} . \tag{23}$$

Here $\hbar\omega_B$ is the excitation energy of the valence electrons and β and α are parameters which may be adjusted to make the theory agree with optical dielectric function measurements in the $k\to 0$ limit. In the $k\to 0$ limit we have

$$\mathrm{Im}\left[\epsilon(0,\omega)\right] = \frac{2^9\pi n e^2}{3\hbar\beta}\,\frac{\alpha^7}{(\omega_B+\frac{\hbar\beta}{m}\alpha^2)}\,\frac{p^3}{(\alpha^2+p^2)^6} . \tag{24}$$

Given the imaginary part of the dielectric function, Eq. (20), for fixed values of n, β, ω_B, and α the real part of $\epsilon(k,\omega)$ may be obtained numerically using the

Kramers-Kronig relation,

$$\mathrm{Re}[\,\epsilon(k,\omega)\,] = 1 + \frac{2P}{\pi}\int_0^\infty d\omega_o \; \frac{\omega_o \,\mathrm{Im}[\,\epsilon(k,\omega_o)\,]}{\omega_o^2 - \omega^2} \quad . \tag{25}$$

We fit Eq. (24) to experimental measurements of the imaginary part of the optical dielectric function as measured by Arakawa and Williams[10] with 15 valence electrons per Al_2O_3 unit, density of Al_2O_3 of 4.05 g/cm^3, $\hbar\omega_s$ = 9 eV, $\beta = \frac{1}{2}$, and αa_o = 0.78. Given these values, $\mathrm{Im}[-\frac{1}{\epsilon(k,\omega)}]$ is calculated from the results of Eq. (20) and Eq. (25). The remaining 9 of the 24 valence electrons in Al_2O_3 are taken to form a second tight-binding level with $\hbar\omega_s$ = 29 eV, $\beta = \frac{1}{2}$, and αa_o = 1.6.

VI. EXCHANGE CORRECTED DIMFP'S AND FORMULAE FOR THE TABULATIONS

We have included the effect of electron exchange in our calculations in a simple manner based on the form of the Mott formula (non-relativistic Møller formula) for scattering of an incident electron with a free electron. The cross section for finding a scattered electron with energy in the interval W:W+dW is given by[8]

$$\frac{d\Phi}{dW} = \frac{\pi e^4}{E}\left[\frac{1}{W^2} + \frac{1}{(E-W)^2} - \frac{1}{W(E-W)}\right] \tag{26}$$

for an incident electron of energy E, except for energies close to W = 0 and W = E. Near W = 0 and W = E the interference term (third term on the right side of Eq. (26)) is effectively zero.

The DIMFP for excitation of an electron from a particular state i may be written in the form

$$\tau_i(E,\hbar\omega) = \frac{1}{E} F_i(E,\hbar\omega) \quad . \tag{27}$$

If we assume that the width of the level from which an electron is excited is quite narrow, we obtain from Eq. (27) the DIMFP for production of a secondary electron with energy E_s as

$$\tau_i^s(E,E_s) = \frac{1}{E} F_i(E, E_i^B + E_s) \tag{28}$$

where E_i^B is the binding energy of the ith state (a positive quantity). The exchange corrected DIMFP is taken as

$$\tau_i^{exc}(E,\hbar\omega) = \frac{1}{E}\Big\{ F_i(E,\hbar\omega) + F_i(E,\ E + E_i^B - \hbar\omega) - \left[1 - \sqrt{E_i^B/E}\right]\left[F_i(E,\hbar\omega)F_i(E,\ E + E_i^B - \hbar\omega)\right]^{1/2}\Big\} \quad . \tag{29}$$

Since $E\tau_i \propto 1/(\hbar\omega)^2$ for large E and $\hbar\omega$, Eq. (29) reduces in this limit to the form given by Eq. (26). The factor $1 - \sqrt{E_i^B/E}$ reduces the contribution of the third term in Eq. (29) as $E \to E_i^B$. This form for the exchange corrected DIMFP has been used in our calculations for all the inner shells and for the two valence levels in Al_2O_3 (since our model assumes the width of these levels to be quite narrow).

If we now define the more energetic of the two electrons after collision to be the primary, and account for exchange through Eq. (29), Eq. (3) gives the

the contribution to the inverse mean free path due to excitation of an electron from the ith level as

$$\mu_i(E) = \int_{E_i^B}^{(E+E_i^B)/2} d(\hbar\omega)\, \tau_i^{exc}(E,\hbar\omega) \quad . \tag{30}$$

Similarly for the stopping power and mean square energy loss per unit path length we have from Eq. (4) and Eq. (5)

$$S_i(E) = \int_{E_i^B}^{(E+E_i^B)/2} d(\hbar\omega)\, \hbar\omega\, \tau_i^{exc}(E,\hbar\omega) \tag{31}$$

and

$$\Omega_i^2(E) = \int_{E_i^B}^{(E+E_i^B)/2} d(\hbar\omega)(\hbar\omega)^2\, \tau_i^{exc}(E,\hbar\omega) \quad . \tag{32}$$

The exchange correction for excitation of electrons from the Al conduction band of finite width requires a slightly different form. We take

$$\tau_{ee}^{exc}(\epsilon,x) = \left\{ \tau_{ee}(\epsilon,x) + \tau_s(\epsilon,\epsilon-x) - [1-(\epsilon+1)^{-1/2}][\tau_{ee}(\epsilon,x)\tau_s(\epsilon,\epsilon-x)]^{1/2} \right\} \tag{33}$$

where τ_{ee} and τ_s are defined in Eq. (12) and Eq. (17). Thus the contributions to the inverse mean free, stopping power, and mean square energy loss per unit path length due to excitation of electrons from the conduction band in Al are calculated from

$$\mu_{ee}(\epsilon) = \int_0^{x/2} dx\, \tau_{ee}^{exc}(\epsilon,x) \quad , \tag{34}$$

$$S_{ee}(\epsilon) = \int_0^{x/2} dx\, x\, \tau_{ee}^{exc}(\epsilon, x) \quad , \tag{35}$$

and

$$\Omega_{ee}^2(\epsilon) = \int_0^{x/2} dx\, x^2\, \tau_{ee}^{exc}(\epsilon, x) \quad . \tag{36}$$

No exchange correction is applied to τ_{pl}, Eq. (14). The inverse mean free path contribution due to plasmon excitation is given by

$$\mu_{pl}(\epsilon) = \int_{x_{min}}^{x_{max}} dx\, \tau_{pl}(\epsilon, x) \quad . \tag{37}$$

The contribution to stopping power and mean square energy loss per unit path length are given by

$$S_{pl}(\epsilon) = \int_{x_{min}}^{x_{max}} dx\, x\, \tau_{pl}(\epsilon, x) \tag{38}$$

and

$$\Omega_{pl}^2(\epsilon) = \int_{x_{min}}^{x_{max}} dx\, x^2\, \tau_{pl}(\epsilon, x) \quad . \tag{39}$$

For the remaining calculations we form the sums

$$S_{exc}(E) = \sum_i S_i(E) \tag{40}$$

and

$$\Omega^2_{exc}(E) = \sum_i \Omega^2_i(E) \tag{41}$$

where the index i includes the terms appropriate for a given solid, including exchange corrections as indicated above. The csda range is calculated from

$$R_{(10)}(E) = \int_{10\ eV}^{E} dE'/S_{exc}(E') \tag{42}$$

corresponding to an electron slowing down in a continuous manner from an energy E to 10 eV. The mean square fluctuation in the csda range based on Eq. (7) is calculated as

$$[\Delta R_{(10)}]^2_{AV} = \int_{10\ eV}^{E} dE'\, \Omega^2_{exc}(E')/[S_{exc}(E')]^3 \ . \tag{43}$$

VII. REFERENCES

1. M. J. Berger and S. M. Seltzer in "Studies in Penetration of Charged Particles in Matter" (National Academy of Sciences-National Research Council, Washington, DC, 1964, Publ. No. 1133) pp. 205-268.
2. L. Pages, et al., Atomic Data 4, 1-127 (1972).
3. S. T. Manson, Phys. Rev. A6, 1013-1024 (1972); S. T. Manson (private communication).
4. E. J. McGuire, Phys. Rev. A3, 267-279 (1971); E. J. McGuire, Sandia Research Report No. SC-RR-70-406 (unpublished).

5. E. Merzbacher and H. W. Lewis in Handbuch der Physik, edited by S. Flügge (Springer-Verlag, Berlin, 1958), pp. 166-192.

6. J. Lindhard, Kgl. Danske Vid. Sels. Mat. Fys. Medd. 28, No. 8, 1-57 (1954).

7. R. H. Ritchie, Phys. Rev. 114, 644-654 (1959).

8. See, e.g., H. A. Bethe and Julius Ashkin in Experimental Nuclear Physics, Vol. 1, edited by E. Segrè (John Wiley & Sons, Inc., New York, 1953) pp. 166-357.

9. See, e.g., D. Pines and P. Nozieres, The Theory of Quantum Liquids: Vol. 1. Normal Fermi Liquids, (W. A. Benjamin, New York, 1966).

10. E. T. Arakawa and M. W. Williams, J. Phys. Chem. Solids 29, 735-744 (1968).

11. J. L. Fry, Phys. Rev. 179, 892-905 (1969).

12. R. H. Ritchie, C. J. Tung, V. E. Anderson, and J. C. Ashley, Rad. Res. 64, 181-204 (1975).

13. R. H. Ritchie, et al., (to be published).

VIII. ALUMINUM: EXPLANATION OF TABLES

GENERAL NOTES

1. Electron energies are measured from the top of the conduction band (Fermi level). The Fermi energy is taken to be $E_F = 11.6$ eV.
2. The density of solid Al is taken to be 2.71 g/cm^3.
3. The computer-printed units are translated as:

EV	eV	A	Å
EV2	$(eV)^2$	A-1	$Å^{-1}$
G/CM3	g/cm^3	A2	$Å^2$

4. The numerical print-out is in the form, e.g.

   2.8D-01 ≡ 2.8×10^{-1} .

TABLE 1A - INVERSE MEAN FREE PATH OF ELECTRONS IN ALUMINUM

EL - EL	μ_{ee} as given by Eq. (34)
PLASMON	μ_{pl} as given by Eq. (37)
AL($n\ell$)	$\mu_{n\ell}^{Al}$ as given by Eq. (30) with Eq. (19)
INVERSE MFP	μ - total inverse mean free path = sum of individual contributions.

TABLE 1B - STOPPING POWER OF ALUMINUM FOR ELECTRONS

EL - EL	S_{ee} as given by Eq. (35)

PLASMON	S_{pl} as given by Eq. (38)
AL($n\ell$)	$S_{n\ell}^{Al}$ as given by Eq. (31) with Eq. (19)
STOPPING POWER	S - total stopping power = sum of individual contributions

TABLE 1C - CSDA RANGES AND STRAGGLING OF ELECTRONS IN ALUMINUM

CSDA RANGE (E TO 10 EV)	$R_{(10)}$ - the range of an electron in the continuous-slowing-down approximation in going from an energy E to 10 eV, as given by Eq. (42).
MEAN SQUARE ENERGY LOSS	Ω_{exc}^2 - the mean square fluctuation in the energy loss per unit path length, as given by Eqs. (41), (36), (39) and (5) plus (19).
MEAN SQUARE RANGE FLUCTUATION	$[\Delta R_{(10)}]_{AV}^2$ - the mean square fluctuation in the range about the mean csda range $R_{(10)}$, as given by Eq. (43).
RELATIVE RANGE STRAGGLING	$\{[\Delta R_{(10)}]_{AV}^2\}^{1/2}/R_{(10)}$

TABLE 1A-INVERSE MEAN FREE PATH OF ELECTRONS IN ALUMINUM (DENSITY 2.71G/CM3)

ELECTRON ENERGY EV	INVERSE MFP A-1	INDIVIDUAL CONTRIBUTIONS TO INVERSE MFP IN UNITS OF A-1				
		EL-EL	PLASMON	AL(2P)	AL(2S)	AL(1S)
5.00D-01	1.358D-04	1.358D-04	0.0	0.0	0.0	0.0
1.00D 00	5.113D-04	5.113D-04	0.0	0.0	0.0	0.0
2.00D 00	1.823D-03	1.823D-03	0.0	0.0	0.0	0.0
3.00D 00	3.679D-03	3.679D-03	0.0	0.0	0.0	0.0
4.00D 00	5.898D-03	5.898D-03	0.0	0.0	0.0	0.0
5.00D 00	8.359D-03	8.359D-03	0.0	0.0	0.0	0.0
6.00D 00	1.097D-02	1.097D-02	0.0	0.0	0.0	0.0
7.00D 00	1.382D-02	1.382D-02	0.0	0.0	0.0	0.0
8.00D 00	1.688D-02	1.688D-02	0.0	0.0	0.0	0.0
9.00D 00	2.014D-02	2.014D-02	0.0	0.0	0.0	0.0
1.00D 01	2.358D-02	2.358D-02	0.0	0.0	0.0	0.0
1.10D 01	2.720D-02	2.720D-02	0.0	0.0	0.0	0.0
1.20D 01	3.099D-02	3.099D-02	0.0	0.0	0.0	0.0
1.30D 01	3.493D-02	3.493D-02	0.0	0.0	0.0	0.0
1.40D 01	3.903D-02	3.903D-02	0.0	0.0	0.0	0.0
1.50D 01	4.328D-02	4.328D-02	0.0	0.0	0.0	0.0
1.60D 01	4.768D-02	4.768D-02	0.0	0.0	0.0	0.0
1.70D 01	5.221D-02	5.221D-02	0.0	0.0	0.0	0.0
1.80D 01	5.688D-02	5.688D-02	0.0	0.0	0.0	0.0
1.90D 01	6.167D-02	6.167D-02	0.0	0.0	0.0	0.0
2.00D 01	6.660D-02	6.660D-02	0.0	0.0	0.0	0.0
2.10D 01	7.165D-02	7.165D-02	0.0	0.0	0.0	0.0
2.20D 01	7.682D-02	7.682D-02	0.0	0.0	0.0	0.0
2.30D 01	1.087D-01	8.120D-02	2.754D-02	0.0	0.0	0.0
2.40D 01	1.366D-01	8.603D-02	5.061D-02	0.0	0.0	0.0
2.50D 01	1.559D-01	9.118D-02	6.468D-02	0.0	0.0	0.0
2.60D 01	1.713D-01	9.578D-02	7.549D-02	0.0	0.0	0.0
2.70D 01	1.840D-01	9.967D-02	8.430D-02	0.0	0.0	0.0
2.80D 01	1.946D-01	1.029D-01	9.169D-02	0.0	0.0	0.0
2.90D 01	2.035D-01	1.055D-01	9.800D-02	0.0	0.0	0.0
3.00D 01	2.111D-01	1.076D-01	1.035D-01	0.0	0.0	0.0
3.20D 01	2.228D-01	1.105D-01	1.123D-01	0.0	0.0	0.0
3.40D 01	2.310D-01	1.118D-01	1.192D-01	0.0	0.0	0.0
3.60D 01	2.364D-01	1.119D-01	1.245D-01	0.0	0.0	0.0
3.80D 01	2.393D-01	1.109D-01	1.286D-01	0.0	0.0	0.0
4.00D 01	2.413D-01	1.094D-01	1.319D-01	0.0	0.0	0.0
4.20D 01	2.420D-01	1.076D-01	1.344D-01	0.0	0.0	0.0
4.40D 01	2.421D-01	1.058D-01	1.363D-01	0.0	0.0	0.0
4.60D 01	2.418D-01	1.040D-01	1.378D-01	0.0	0.0	0.0
4.80D 01	2.417D-01	1.029D-01	1.388D-01	0.0	0.0	0.0
5.00D 01	2.419D-01	1.024D-01	1.395D-01	0.0	0.0	0.0
5.20D 01	2.417D-01	1.018D-01	1.400D-01	0.0	0.0	0.0
5.40D 01	2.414D-01	1.012D-01	1.402D-01	0.0	0.0	0.0
5.60D 01	2.408D-01	1.006D-01	1.402D-01	0.0	0.0	0.0
5.80D 01	2.399D-01	9.982D-02	1.401D-01	0.0	0.0	0.0
6.00D 01	2.388D-01	9.901D-02	1.398D-01	0.0	0.0	0.0
6.20D 01	2.375D-01	9.812D-02	1.395D-01	0.0	0.0	0.0
6.40D 01	2.362D-01	9.718D-02	1.390D-01	0.0	0.0	0.0
6.60D 01	2.346D-01	9.619D-02	1.385D-01	0.0	0.0	0.0
6.80D 01	2.330D-01	9.516D-02	1.378D-01	0.0	0.0	0.0
7.00D 01	2.313D-01	9.410D-02	1.372D-01	0.0	0.0	0.0
7.20D 01	2.295D-01	9.303D-02	1.365D-01	0.0	0.0	0.0
7.40D 01	2.275D-01	9.195D-02	1.357D-01	0.0	0.0	0.0

TABLE 1A-INVERSE MEAN FREE PATH OF ELECTRONS IN ALUMINUM (DENSITY 2.71G/CM3)

ELECTRON ENERGY EV	INVERSE MFP A-1	INDIVIDUAL CONTRIBUTIONS TO INVERSE MFP IN UNITS OF A-1				
		EL-EL	PLASMON	AL(2P)	AL(2S)	AL(1S)
7.60D 01	2.258D-01	9.086D-02	1.349D-01	0.0	0.0	0.0
7.80D 01	2.239D-01	8.977D-02	1.341D-01	0.0	0.0	0.0
8.00D 01	2.219D-01	8.868D-02	1.333D-01	0.0	0.0	0.0
8.200 01	2.200D-01	8.760D-02	1.324D-01	0.0	0.0	0.0
8.40D 01	2.181D-01	8.653D-02	1.315D-01	0.0	0.0	0.0
8.60D 01	2.161D-01	8.547D-02	1.307D-01	0.0	0.0	0.0
8.80D 01	2.142D-01	8.442D-02	1.298D-01	0.0	0.0	0.0
9.00D 01	2.123D-01	8.339D-02	1.289D-01	0.0	0.0	0.0
9.20D 01	2.104D-01	8.237D-02	1.280D-01	0.0	0.0	0.0
9.40D 01	2.086D-01	8.137D-02	1.271D-01	8.520D-05	0.0	0.0
9.60D 01	2.068D-01	8.038D-02	1.262D-01	2.016D-04	0.0	0.0
9.80D 01	2.051D-01	7.941D-02	1.253D-01	3.208D-04	0.0	0.0
1.00D 02	2.034D-01	7.846D-02	1.245D-01	4.414D-04	0.0	0.0
1.10D 02	1.951D-01	7.395D-02	1.201D-01	1.035D-03	0.0	0.0
1.20D 02	1.874D-01	6.986D-02	1.159D-01	1.572D-03	0.0	0.0
1.30D 02	1.802D-01	6.616D-02	1.120D-01	2.092D-03	0.0	0.0
1.40D 02	1.737D-01	6.280D-02	1.082D-01	2.588D-03	6.595D-05	0.0
1.50D 02	1.676D-01	5.974D-02	1.047D-01	3.024D-03	1.333D-04	0.0
1.60D 02	1.620D-01	5.696D-02	1.014D-01	3.397D-03	1.998D-04	0.0
1.70D 02	1.567D-01	5.442D-02	9.833D-02	3.704D-03	2.647D-04	0.0
1.80D 02	1.518D-01	5.209D-02	9.542D-02	3.954D-03	3.271D-04	0.0
1.90D 02	1.472D-01	4.995D-02	9.269D-02	4.153D-03	3.870D-04	0.0
2.00D 02	1.429D-01	4.797D-02	9.011D-02	4.361D-03	4.442D-04	0.0
2.10D 02	1.389D-01	4.615D-02	8.768D-02	4.559D-03	4.983D-04	0.0
2.20D 02	1.351D-01	4.445D-02	8.539D-02	4.732D-03	5.492D-04	0.0
2.30D 02	1.316D-01	4.288D-02	8.323D-02	4.881D-03	5.967D-04	0.0
2.40D 02	1.282D-01	4.142D-02	8.118D-02	5.006D-03	6.411D-04	0.0
2.50D 02	1.251D-01	4.005D-02	7.924D-02	5.110D-03	6.826D-04	0.0
2.60D 02	1.221D-01	3.876D-02	7.739D-02	5.193D-03	7.213D-04	0.0
2.70D 02	1.192D-01	3.756D-02	7.564D-02	5.272D-03	7.404D-04	0.0
2.80D 02	1.165D-01	3.643D-02	7.397D-02	5.343D-03	7.563D-04	0.0
2.90D 02	1.139D-01	3.537D-02	7.239D-02	5.404D-03	7.702D-04	0.0
3.00D 02	1.115D-01	3.436D-02	7.087D-02	5.456D-03	7.825D-04	0.0
3.10D 02	1.091D-01	3.341D-02	6.943D-02	5.500D-03	7.933D-04	0.0
3.20D 02	1.069D-01	3.251D-02	6.805D-02	5.536D-03	8.028D-04	0.0
3.30D 02	1.048D-01	3.166D-02	6.673D-02	5.563D-03	8.111D-04	0.0
3.40D 02	1.027D-01	3.086D-02	6.546D-02	5.583D-03	8.183D-04	0.0
3.50D 02	1.008D-01	3.009D-02	6.425D-02	5.599D-03	8.246D-04	0.0
3.60D 02	9.888D-02	2.936D-02	6.308D-02	5.611D-03	8.302D-04	0.0
3.70D 02	9.708D-02	2.867D-02	6.196D-02	5.620D-03	8.351D-04	0.0
3.80D 02	9.533D-02	2.800D-02	6.088D-02	5.627D-03	8.395D-04	0.0
3.90D 02	9.370D-02	2.737D-02	5.985D-02	5.632D-03	8.434D-04	0.0
4.000 02	9.210D-02	2.677D-02	5.885D-02	5.633D-03	8.452D-04	0.0
4.10D 02	9.055D-02	2.619D-02	5.789D-02	5.632D-03	8.437D-04	0.0
4.20D 02	8.907D-02	2.564D-02	5.697D-02	5.629D-03	8.420D-04	0.0
4.30D 02	8.764D-02	2.511D-02	5.607D-02	5.623D-03	8.401D-04	0.0
4.40D 02	8.625D-02	2.460D-02	5.521D-02	5.615D-03	8.381D-04	0.0
4.50D 02	8.492D-02	2.411D-02	5.437D-02	5.605D-03	8.359D-04	0.0
4.60D 02	8.363D-02	2.364D-02	5.357D-02	5.592D-03	8.337D-04	0.0
4.70D 02	8.238D-02	2.319D-02	5.279D-02	5.577D-03	8.315D-04	0.0
4.80D 02	8.118D-02	2.275D-02	5.203D-02	5.561D-03	8.291D-04	0.0
4.90D 02	8.001D-02	2.233D-02	5.130D-02	5.545D-03	8.268D-04	0.0
5.00D 02	7.888D-02	2.193D-02	5.059D-02	5.529D-03	8.244D-04	0.0

TABLE 1A-INVERSE MEAN FREE PATH OF ELECTRONS IN ALUMINUM (DENSITY 2.71G/CM3)

ELECTRON ENERGY eV	INVERSE MFP A-1	INDIVIDUAL CONTRIBUTIONS TO INVERSE MFP IN UNITS OF A-1				
		EL-EL	PLASMON	AL(2P)	AL(2S)	AL(1S)
5.10D 02	7.773D-02	2.154D-02	4.990D-02	5.513D-03	8.219D-04	0.0
5.20D 02	7.672D-02	2.117D-02	4.924D-02	5.496D-03	8.195D-04	0.0
5.30D 02	7.569D-02	2.080D-02	4.859D-02	5.477D-03	8.170D-04	0.0
5.40D 02	7.468D-02	2.045D-02	4.796D-02	5.453D-03	8.126D-04	0.0
5.50D 02	7.370D-02	2.012D-02	4.735D-02	5.429D-03	8.077D-04	0.0
5.60D 02	7.275D-02	1.979D-02	4.675D-02	5.404D-03	8.029D-04	0.0
5.70D 02	7.183D-02	1.947D-02	4.618D-02	5.379D-03	7.982D-04	0.0
5.80D 02	7.093D-02	1.917D-02	4.562D-02	5.355D-03	7.935D-04	0.0
5.90D 02	7.005D-02	1.887D-02	4.507D-02	5.330D-03	7.889D-04	0.0
6.00D 02	6.920D-02	1.858D-02	4.453D-02	5.306D-03	7.843D-04	0.0
6.10D 02	6.838D-02	1.830D-02	4.402D-02	5.283D-03	7.798D-04	0.0
6.20D 02	6.758D-02	1.803D-02	4.351D-02	5.260D-03	7.754D-04	0.0
6.30D 02	6.679D-02	1.777D-02	4.302D-02	5.237D-03	7.711D-04	0.0
6.40D 02	6.603D-02	1.751D-02	4.254D-02	5.215D-03	7.668D-04	0.0
6.50D 02	6.528D-02	1.726D-02	4.207D-02	5.192D-03	7.627D-04	0.0
6.60D 02	6.455D-02	1.702D-02	4.161D-02	5.170D-03	7.586D-04	0.0
6.70D 02	6.385D-02	1.679D-02	4.117D-02	5.147D-03	7.546D-04	0.0
6.80D 02	6.316D-02	1.656D-02	4.073D-02	5.118D-03	7.507D-04	0.0
6.90D 02	6.248D-02	1.634D-02	4.030D-02	5.090D-03	7.469D-04	0.0
7.00D 02	6.181D-02	1.612D-02	3.989D-02	5.063D-03	7.432D-04	0.0
7.10D 02	6.116D-02	1.591D-02	3.948D-02	5.037D-03	7.395D-04	0.0
7.20D 02	6.053D-02	1.571D-02	3.908D-02	5.011D-03	7.358D-04	0.0
7.30D 02	5.992D-02	1.551D-02	3.869D-02	4.987D-03	7.322D-04	0.0
7.40D 02	5.932D-02	1.531D-02	3.832D-02	4.963D-03	7.287D-04	0.0
7.50D 02	5.873D-02	1.512D-02	3.794D-02	4.941D-03	7.252D-04	0.0
7.60D 02	5.815D-02	1.494D-02	3.758D-02	4.939D-03	7.218D-04	0.0
7.70D 02	5.759D-02	1.475D-02	3.722D-02	4.898D-03	7.184D-04	0.0
7.80D 02	5.703D-02	1.458D-02	3.687D-02	4.875D-03	7.151D-04	0.0
7.90D 02	5.649D-02	1.441D-02	3.653D-02	4.854D-03	7.118D-04	0.0
8.00D 02	5.597D-02	1.424D-02	3.620D-02	4.831D-03	7.086D-04	0.0
8.10D 02	5.547D-02	1.407D-02	3.587D-02	4.808D-03	7.047D-04	0.0
8.20D 02	5.496D-02	1.391D-02	3.555D-02	4.787D-03	7.003D-04	0.0
8.30D 02	5.445D-02	1.376D-02	3.523D-02	4.765D-03	6.960D-04	0.0
8.40D 02	5.395D-02	1.360D-02	3.492D-02	4.742D-03	6.917D-04	0.0
8.50D 02	5.348D-02	1.345D-02	3.462D-02	4.718D-03	6.875D-04	0.0
8.60D 02	5.301D-02	1.331D-02	3.432D-02	4.697D-03	6.834D-04	0.0
8.70D 02	5.254D-02	1.316D-02	3.403D-02	4.673D-03	6.794D-04	0.0
8.80D 02	5.209D-02	1.302D-02	3.374D-02	4.648D-03	6.754D-04	0.0
8.90D 02	5.164D-02	1.289D-02	3.346D-02	4.624D-03	6.715D-04	0.0
9.00D 02	5.120D-02	1.275D-02	3.319D-02	4.599D-03	6.676D-04	0.0
9.10D 02	5.077D-02	1.262D-02	3.292D-02	4.575D-03	6.638D-04	0.0
9.20D 02	5.035D-02	1.249D-02	3.265D-02	4.551D-03	6.601D-04	0.0
9.30D 02	4.993D-02	1.236D-02	3.239D-02	4.527D-03	6.564D-04	0.0
9.40D 02	4.952D-02	1.224D-02	3.213D-02	4.503D-03	6.529D-04	0.0
9.50D 02	4.912D-02	1.212D-02	3.188D-02	4.480D-03	6.493D-04	0.0
9.60D 02	4.873D-02	1.200D-02	3.163D-02	4.457D-03	6.459D-04	0.0
9.70D 02	4.834D-02	1.188D-02	3.139D-02	4.433D-03	6.424D-04	0.0
9.80D 02	4.796D-02	1.177D-02	3.115D-02	4.410D-03	6.391D-04	0.0
9.90D 02	4.759D-02	1.166D-02	3.091D-02	4.388D-03	6.358D-04	0.0
1.00D 03	4.722D-02	1.155D-02	3.068D-02	4.365D-03	6.326D-04	0.0
1.05D 03	4.547D-02	1.102D-02	2.957D-02	4.255D-03	6.172D-04	0.0
1.10D 03	4.386D-02	1.055D-02	2.856D-02	4.151D-03	6.018D-04	0.0
1.15D 03	4.236D-02	1.011D-02	2.761D-02	4.051D-03	5.865D-04	0.0

TABLE 1A-INVERSE MEAN FREE PATH OF ELECTRONS IN ALUMINUM (DENSITY 2.71G/CM3)

ELECTRON ENERGY EV	INVERSE MFP A-1	INDIVIDUAL CONTRIBUTIONS TO INVERSE MFP IN UNITS OF A-1				
		EL-EL	PLASMON	AL(2P)	AL(2S)	AL(1S)
1.20D 03	4.097D-02	9.711D-03	2.673D-02	3.955D-03	5.725D-04	0.0
1.25D 03	3.968D-02	9.340D-03	2.592D-02	3.864D-03	5.597D-04	0.0
1.30D 03	3.847D-02	8.997D-03	2.515D-02	3.777D-03	5.470D-04	0.0
1.35D 03	3.733D-02	8.678D-03	2.443D-02	3.694D-03	5.335D-04	0.0
1.40D 03	3.627D-02	8.381D-03	2.376D-02	3.614D-03	5.215D-04	0.0
1.45D 03	3.528D-02	8.104D-03	2.313D-02	3.538D-03	5.086D-04	0.0
1.50D 03	3.433D-02	7.844D-03	2.253D-02	3.465D-03	4.978D-04	0.0
1.55D 03	3.344D-02	7.601D-03	2.196D-02	3.394D-03	4.874D-04	0.0
1.60D 03	3.260D-02	7.372D-03	2.143D-02	3.326D-03	4.773D-04	4.180D-08
1.65D 03	3.181D-02	7.157D-03	2.092D-02	3.261D-03	4.676D-04	1.556D-07
1.70D 03	3.105D-02	6.954D-03	2.044D-02	3.198D-03	4.582D-04	2.884D-07
1.75D 03	3.033D-02	6.762D-03	1.998D-02	3.138D-03	4.492D-04	4.338D-07
1.80D 03	2.964D-02	6.580D-03	1.954D-02	3.080D-03	4.406D-04	5.877D-07
1.85D 03	2.899D-02	6.408D-03	1.913D-02	3.024D-03	4.322D-04	7.461D-07
1.90D 03	2.837D-02	6.245D-03	1.873D-02	2.970D-03	4.242D-04	9.036D-07
1.95D 03	2.778D-02	6.090D-03	1.835D-02	2.918D-03	4.164D-04	1.058D-06
2.00D 03	2.721D-02	5.943D-03	1.799D-02	2.868D-03	4.089D-04	1.208D-06
2.05D 03	2.667D-02	5.802D-03	1.764D-02	2.820D-03	4.016D-04	1.351D-06
2.10D 03	2.615D-02	5.668D-03	1.731D-02	2.774D-03	3.946D-04	1.489D-06
2.15D 03	2.565D-02	5.540D-03	1.699D-02	2.729D-03	3.879D-04	1.619D-06
2.20D 03	2.517D-02	5.418D-03	1.669D-02	2.686D-03	3.814D-04	1.752D-06
2.25D 03	2.471D-02	5.301D-03	1.639D-02	2.644D-03	3.751D-04	1.884D-06
2.30D 03	2.427D-02	5.189D-03	1.611D-02	2.604D-03	3.690D-04	2.011D-06
2.35D 03	2.384D-02	5.081D-03	1.583D-02	2.566D-03	3.632D-04	2.133D-06
2.40D 03	2.343D-02	4.978D-03	1.557D-02	2.528D-03	3.575D-04	2.250D-06
2.45D 03	2.304D-02	4.879D-03	1.531D-02	2.492D-03	3.521D-04	2.362D-06
2.50D 03	2.266D-02	4.784D-03	1.507D-02	2.457D-03	3.468D-04	2.469D-06
2.55D 03	2.230D-02	4.693D-03	1.483D-02	2.424D-03	3.417D-04	2.572D-06
2.60D 03	2.194D-02	4.605D-03	1.461D-02	2.391D-03	3.368D-04	2.671D-06
2.65D 03	2.160D-02	4.520D-03	1.439D-02	2.360D-03	3.320D-04	2.765D-06
2.70D 03	2.127D-02	4.438D-03	1.417D-02	2.329D-03	3.274D-04	2.857D-06
2.75D 03	2.095D-02	4.359D-03	1.396D-02	2.300D-03	3.229D-04	2.940D-06
2.80D 03	2.064D-02	4.283D-03	1.376D-02	2.271D-03	3.186D-04	3.019D-06
2.85D 03	2.034D-02	4.210D-03	1.357D-02	2.243D-03	3.144D-04	3.094D-06
2.90D 03	2.004D-02	4.139D-03	1.338D-02	2.215D-03	3.104D-04	3.167D-06
2.95D 03	1.976D-02	4.070D-03	1.320D-02	2.188D-03	3.064D-04	3.236D-06
3.00D 03	1.949D-02	4.004D-03	1.302D-02	2.162D-03	3.026D-04	3.302D-06
3.10D 03	1.897D-02	3.878D-03	1.268D-02	2.112D-03	2.953D-04	3.427D-06
3.20D 03	1.847D-02	3.759D-03	1.236D-02	2.064D-03	2.884D-04	3.542D-06
3.30D 03	1.801D-02	3.647D-03	1.205D-02	2.018D-03	2.819D-04	3.644D-06
3.40D 03	1.756D-02	3.542D-03	1.177D-02	1.974D-03	2.758D-04	3.735D-06
3.50D 03	1.714D-02	3.443D-03	1.149D-02	1.933D-03	2.700D-04	3.817D-06
3.60D 03	1.674D-02	3.349D-03	1.123D-02	1.893D-03	2.645D-04	3.892D-06
3.70D 03	1.636D-02	3.260D-03	1.099D-02	1.855D-03	2.593D-04	3.961D-06
3.80D 03	1.600D-02	3.176D-03	1.075D-02	1.818D-03	2.543D-04	4.023D-06
3.90D 03	1.566D-02	3.096D-03	1.053D-02	1.783D-03	2.496D-04	4.081D-06
4.00D 03	1.533D-02	3.020D-03	1.031D-02	1.750D-03	2.452D-04	4.133D-06
4.10D 03	1.501D-02	2.948D-03	1.010D-02	1.718D-03	2.410D-04	4.179D-06
4.20D 03	1.471D-02	2.879D-03	9.903D-03	1.687D-03	2.369D-04	4.215D-06
4.30D 03	1.442D-02	2.813D-03	9.713D-03	1.657D-03	2.329D-04	4.248D-06
4.40D 03	1.414D-02	2.750D-03	9.531D-03	1.628D-03	2.290D-04	4.277D-06
4.50D 03	1.388D-02	2.690D-03	9.358D-03	1.601D-03	2.251D-04	4.303D-06
4.60D 03	1.363D-02	2.632D-03	9.193D-03	1.574D-03	2.214D-04	4.327D-06

TABLE 1A-INVERSE MEAN FREE PATH OF ELECTRONS IN ALUMINUM (DENSITY 2.71G/CM3)

ELECTRON ENERGY EV	INVERSE MFP A-1	INDIVIDUAL CONTRIBUTIONS TO INVERSE MFP IN UNITS OF A-1				
		EL-EL	PLASMON	AL(2P)	AL(2S)	AL(1S)
4.70D 03	1.338D-02	2.577D-03	9.032D-03	1.549D-03	2.178D-04	4.345D-06
4.80D 03	1.314D-02	2.524D-03	8.877D-03	1.524D-03	2.143D-04	4.360D-06
4.90D 03	1.292D-02	2.473D-03	8.728D-03	1.500D-03	2.109D-04	4.365D-06
5.00D 03	1.270D-02	2.425D-03	8.583D-03	1.477D-03	2.077D-04	4.368D-06
5.10D 03	1.249D-02	2.378D-03	8.444D-03	1.455D-03	2.045D-04	4.368D-06
5.20D 03	1.228D-02	2.333D-03	8.309D-03	1.433D-03	2.014D-04	4.367D-06
5.30D 03	1.208D-02	2.289D-03	8.179D-03	1.412D-03	1.985D-04	4.363D-06
5.40D 03	1.189D-02	2.247D-03	8.052D-03	1.392D-03	1.956D-04	4.358D-06
5.50D 03	1.171D-02	2.207D-03	7.930D-03	1.372D-03	1.928D-04	4.353D-06
5.60D 03	1.153D-02	2.168D-03	7.812D-03	1.353D-03	1.901D-04	4.347D-06
5.70D 03	1.135D-02	2.131D-03	7.700D-03	1.335D-03	1.874D-04	4.338D-06
5.80D 03	1.119D-02	2.094D-03	7.591D-03	1.317D-03	1.849D-04	4.327D-06
5.90D 03	1.103D-02	2.059D-03	7.485D-03	1.300D-03	1.824D-04	4.317D-06
6.00D 03	1.087D-02	2.025D-03	7.381D-03	1.283D-03	1.800D-04	4.304D-06
6.10D 03	1.072D-02	1.992D-03	7.281D-03	1.266D-03	1.776D-04	4.291D-06
6.20D 03	1.057D-02	1.961D-03	7.184D-03	1.250D-03	1.754D-04	4.275D-06
6.30D 03	1.043D-02	1.930D-03	7.089D-03	1.235D-03	1.731D-04	4.259D-06
6.40D 03	1.029D-02	1.900D-03	6.997D-03	1.220D-03	1.710D-04	4.243D-06
6.50D 03	1.016D-02	1.871D-03	6.907D-03	1.205D-03	1.689D-04	4.223D-06
6.60D 03	1.002D-02	1.843D-03	6.819D-03	1.190D-03	1.668D-04	4.207D-06
6.70D 03	9.895D-03	1.816D-03	6.734D-03	1.176D-03	1.648D-04	4.190D-06
6.80D 03	9.770D-03	1.790D-03	6.651D-03	1.163D-03	1.629D-04	4.173D-06
6.90D 03	9.645D-03	1.764D-03	6.570D-03	1.149D-03	1.610D-04	4.156D-06
7.00D 03	9.529D-03	1.739D-03	6.491D-03	1.136D-03	1.591D-04	4.138D-06
7.10D 03	9.414D-03	1.715D-03	6.414D-03	1.124D-03	1.573D-04	4.121D-06
7.20D 03	9.301D-03	1.691D-03	6.338D-03	1.111D-03	1.556D-04	4.102D-06
7.30D 03	9.190D-03	1.668D-03	6.265D-03	1.099D-03	1.539D-04	4.084D-06
7.40D 03	9.035D-03	1.646D-03	6.195D-03	1.088D-03	1.522D-04	4.066D-06
7.50D 03	8.981D-03	1.624D-03	6.126D-03	1.076D-03	1.505D-04	4.047D-06
7.60D 03	8.880D-03	1.603D-03	6.060D-03	1.065D-03	1.489D-04	4.029D-06
7.70D 03	8.782D-03	1.583D-03	5.994D-03	1.054D-03	1.473D-04	4.010D-06
7.80D 03	8.685D-03	1.562D-03	5.931D-03	1.043D-03	1.458D-04	3.991D-06
7.90D 03	8.592D-03	1.543D-03	5.868D-03	1.033D-03	1.443D-04	3.973D-06
8.00D 03	8.499D-03	1.524D-03	5.807D-03	1.022D-03	1.428D-04	3.954D-06
8.10D 03	8.409D-03	1.505D-03	5.747D-03	1.012D-03	1.414D-04	3.935D-06
8.20D 03	8.321D-03	1.487D-03	5.688D-03	1.002D-03	1.400D-04	3.917D-06
8.30D 03	8.235D-03	1.469D-03	5.631D-03	9.926D-04	1.386D-04	3.898D-06
8.40D 03	8.151D-03	1.452D-03	5.575D-03	9.832D-04	1.373D-04	3.879D-06
8.50D 03	8.069D-03	1.435D-03	5.520D-03	9.739D-04	1.359D-04	3.861D-06
8.60D 03	7.987D-03	1.418D-03	5.466D-03	9.648D-04	1.346D-04	3.842D-06
8.70D 03	7.908D-03	1.402D-03	5.413D-03	9.559D-04	1.334D-04	3.823D-06
8.80D 03	7.830D-03	1.386D-03	5.360D-03	9.472D-04	1.321D-04	3.804D-06
8.90D 03	7.754D-03	1.371D-03	5.310D-03	9.387D-04	1.309D-04	3.785D-06
9.00D 03	7.679D-03	1.356D-03	5.260D-03	9.303D-04	1.297D-04	3.767D-06
9.10D 03	7.605D-03	1.341D-03	5.211D-03	9.221D-04	1.285D-04	3.748D-06
9.20D 03	7.535D-03	1.327D-03	5.163D-03	9.140D-04	1.274D-04	3.729D-06
9.30D 03	7.465D-03	1.313D-03	5.116D-03	9.061D-04	1.263D-04	3.710D-06
9.40D 03	7.396D-03	1.299D-03	5.070D-03	8.983D-04	1.252D-04	3.692D-06
9.50D 03	7.328D-03	1.285D-03	5.024D-03	8.907D-04	1.241D-04	3.673D-06
9.60D 03	7.261D-03	1.272D-03	4.980D-03	8.832D-04	1.230D-04	3.655D-06
9.70D 03	7.196D-03	1.259D-03	4.936D-03	8.759D-04	1.220D-04	3.637D-06
9.80D 03	7.13[illegible]D-03	1.246D-03	4.893D-03	8.686D-04	1.209D-04	3.618D-06
9.90D 03	7.069D-03	1.234D-03	4.851D-03	8.615D-04	1.199D-04	3.600D-06
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]

ELECTRON ENERGY EV	STOPPING POWER EV/A	INDIVIDUAL CONTRIBUTIONS TO THE STOPPING POWER IN UNITS OF EV/A				
		EL-EL	PLASMON	AL(2P)	AL(2S)	AL(1S)
5.00D-01	2.260D-05	2.260D-05	0.0	0.0	0.0	0.0
1.00D 00	1.700D-04	1.700D-04	0.0	0.0	0.0	0.0
2.00D 00	1.209D-03	1.209D-03	0.0	0.0	0.0	0.0
3.00D 00	3.649D-03	3.649D-03	0.0	0.0	0.0	0.0
4.00D 00	7.778D-03	7.778D-03	0.0	0.0	0.0	0.0
5.00D 00	1.374D-02	1.374D-02	0.0	0.0	0.0	0.0
6.00D 00	2.159D-02	2.159D-02	0.0	0.0	0.0	0.0
7.00D 00	3.131D-02	3.131D-02	0.0	0.0	0.0	0.0
8.00D 00	4.368D-02	4.368D-02	0.0	0.0	0.0	0.0
9.00D 00	5.857D-02	5.857D-02	0.0	0.0	0.0	0.0
1.00D 01	7.615D-02	7.615D-02	0.0	0.0	0.0	0.0
1.10D 01	9.657D-02	9.657D-02	0.0	0.0	0.0	0.0
1.20D 01	1.199D-01	1.199D-01	0.0	0.0	0.0	0.0
1.30D 01	1.464D-01	1.464D-01	0.0	0.0	0.0	0.0
1.40D 01	1.761D-01	1.761D-01	0.0	0.0	0.0	0.0
1.50D 01	2.091D-01	2.091D-01	0.0	0.0	0.0	0.0
1.60D 01	2.456D-01	2.456D-01	0.0	0.0	0.0	0.0
1.70D 01	2.857D-01	2.857D-01	0.0	0.0	0.0	0.0
1.80D 01	3.220D-01	3.220D-01	0.0	0.0	0.0	0.0
1.90D 01	3.606D-01	3.606D-01	0.0	0.0	0.0	0.0
2.00D 01	4.017D-01	4.017D-01	0.0	0.0	0.0	0.0
2.10D 01	4.452D-01	4.452D-01	0.0	0.0	0.0	0.0
2.20D 01	4.916D-01	4.916D-01	0.0	0.0	0.0	0.0
2.30D 01	1.146D 00	5.410D-01	6.054D-01	0.0	0.0	0.0
2.40D 01	1.670D 00	5.934D-01	1.076D 00	0.0	0.0	0.0
2.50D 01	2.001D 00	6.492D-01	1.352D 00	0.0	0.0	0.0
2.60D 01	2.266D 00	7.079D-01	1.558D 00	0.0	0.0	0.0
2.70D 01	2.491D 00	7.688D-01	1.722D 00	0.0	0.0	0.0
2.80D 01	2.688D 00	8.308D-01	1.857D 00	0.0	0.0	0.0
2.90D 01	2.863D 00	8.930D-01	1.970D 00	0.0	0.0	0.0
3.00D 01	3.021D 00	9.550D-01	2.066D 00	0.0	0.0	0.0
3.20D 01	3.294D 00	1.075D 00	2.219D 00	0.0	0.0	0.0
3.40D 01	3.520D 00	1.188D 00	2.332D 00	0.0	0.0	0.0
3.60D 01	3.706D 00	1.288D 00	2.418D 00	0.0	0.0	0.0
3.80D 01	3.855D 00	1.374D 00	2.482D 00	0.0	0.0	0.0
4.00D 01	3.977D 00	1.448D 00	2.529D 00	0.0	0.0	0.0
4.20D 01	4.075D 00	1.511D 00	2.564D 00	0.0	0.0	0.0
4.40D 01	4.155D 00	1.567D 00	2.588D 00	0.0	0.0	0.0
4.60D 01	4.220D 00	1.616D 00	2.604D 00	0.0	0.0	0.0
4.80D 01	4.283D 00	1.669D 00	2.614D 00	0.0	0.0	0.0
5.00D 01	4.346D 00	1.728D 00	2.618D 00	0.0	0.0	0.0
5.20D 01	4.394D 00	1.776D 00	2.618D 00	0.0	0.0	0.0
5.40D 01	4.433D 00	1.819D 00	2.614D 00	0.0	0.0	0.0
5.60D 01	4.463D 00	1.856D 00	2.607D 00	0.0	0.0	0.0
5.80D 01	4.485D 00	1.887D 00	2.598D 00	0.0	0.0	0.0
6.00D 01	4.498D 00	1.912D 00	2.586D 00	0.0	0.0	0.0
6.20D 01	4.506D 00	1.932D 00	2.573D 00	0.0	0.0	0.0
6.40D 01	4.507D 00	1.948D 00	2.559D 00	0.0	0.0	0.0
6.60D 01	4.504D 00	1.960D 00	2.544D 00	0.0	0.0	0.0
6.80D 01	4.497D 00	1.969D 00	2.527D 00	0.0	0.0	0.0
7.00D 01	4.486D 00	1.975D 00	2.510D 00	0.0	0.0	0.0
7.20D 01	4.472D 00	1.979D 00	2.493D 00	0.0	0.0	0.0
7.40D 01	4.455D 00	1.980D 00	2.475D 00	0.0	0.0	0.0

TABLE 18-STOPPING POWER OF ALUMINUM (DENSITY 2.71G/CM3) FOR ELECTRONS

ELECTRON ENERGY EV	STOPPING POWER EV/A	INDIVIDUAL CONTRIBUTIONS TO THE STOPPING POWER IN UNITS OF EV/A				
		EL-EL	PLASMON	AL(2P)	AL(2S)	AL(1S)
7.60D 01	4.437D 00	1.980D 00	2.457D 00	0.0	0.0	0.0
7.80D 01	4.416D 00	1.978D 00	2.438D 00	0.0	0.0	0.0
8.00D 01	4.394D 00	1.975D 00	2.419D 00	0.0	0.0	0.0
8.20D 01	4.371D 00	1.971D 00	2.400D 00	0.0	0.0	0.0
8.40D 01	4.347D 00	1.965D 00	2.382D 00	0.0	0.0	0.0
8.60D 01	4.322D 00	1.959D 00	2.363D 00	0.0	0.0	0.0
8.80D 01	4.296D 00	1.952D 00	2.344D 00	0.0	0.0	0.0
9.00D 01	4.269D 00	1.945D 00	2.325D 00	0.0	0.0	0.0
9.20D 01	4.242D 00	1.936D 00	2.306D 00	0.0	0.0	0.0
9.40D 01	4.223D 00	1.928D 00	2.288D 00	7.912D-03	0.0	0.0
9.60D 01	4.206D 00	1.919D 00	2.269D 00	1.883D-02	0.0	0.0
9.80D 01	4.190D 00	1.909D 00	2.251D 00	3.011D-02	0.0	0.0
1.00D 02	4.174D 00	1.899D 00	2.233D 00	4.166D-02	0.0	0.0
1.10D 02	4.092D 00	1.847D 00	2.145D 00	1.002D-01	0.0	0.0
1.20D 02	4.012D 00	1.793D 00	2.062D 00	1.562D-01	0.0	0.0
1.30D 02	3.938D 00	1.740D 00	1.985D 00	2.130D-01	0.0	0.0
1.40D 02	3.878D 00	1.687D 00	1.913D 00	2.697D-01	8.746D-03	0.0
1.50D 02	3.823D 00	1.636D 00	1.846D 00	3.223D-01	1.801D-02	0.0
1.60D 02	3.769D 00	1.588D 00	1.784D 00	3.699D-01	2.751D-02	0.0
1.70D 02	3.716D 00	1.542D 00	1.725D 00	4.118D-01	3.713D-02	0.0
1.80D 02	3.664D 00	1.498D 00	1.671D 00	4.483D-01	4.672D-02	0.0
1.90D 02	3.613D 00	1.456D 00	1.620D 00	4.798D-01	5.625D-02	0.0
2.00D 02	3.568D 00	1.417D 00	1.573D 00	5.124D-01	6.566D-02	0.0
2.10D 02	3.527D 00	1.380D 00	1.528D 00	5.442D-01	7.488D-02	0.0
2.20D 02	3.488D 00	1.345D 00	1.486D 00	5.735D-01	8.385D-02	0.0
2.30D 02	3.450D 00	1.311D 00	1.446D 00	6.002D-01	9.253D-02	0.0
2.40D 02	3.413D 00	1.279D 00	1.409D 00	6.244D-01	1.009D-01	0.0
2.50D 02	3.378D 00	1.249D 00	1.373D 00	6.460D-01	1.090D-01	0.0
2.60D 02	3.343D 00	1.220D 00	1.340D 00	6.654D-01	1.168D-01	0.0
2.70D 02	3.307D 00	1.193D 00	1.308D 00	6.837D-01	1.215D-01	0.0
2.80D 02	3 272D 00	1.167D 00	1.278D 00	7.008D-01	1.257D-01	0.0
2.90D 02	3.238D 00	1.142D 00	1.250D 00	7.168D-01	1.296D-01	0.0
3.00D 02	3.205D 00	1.118D 00	1.222D 00	7.315D-01	1.332D-01	0.0
3.10D 02	3.174D 00	1.096D 00	1.197D 00	7.452D-01	1.365D-01	0.0
3.20D 02	3.143D 00	1.074D 00	1.172D 00	7.577D-01	1.397D-01	0.0
3.30D 02	3.113D 00	1.053D 00	1.148D 00	7.689D-01	1.426D-01	0.0
3.40D 02	3.083D 00	1.033D 00	1.125D 00	7.789D-01	1.454D-01	0.0
3.50D 02	3.054D 00	1.014D 00	1.104D 00	7.882D-01	1.480D-01	0.0
3.60D 02	3.026D 00	9.955D-01	1.083D 00	7.967D-01	1.504D-01	0.0
3.70D 02	2.998D 00	9.780D-01	1.063D 00	8.047D-01	1.527D-01	0.0
3.80D 02	2.972D 00	9.610D-01	1.044D 00	8.121D-01	1.549D-01	0.0
3.90D 02	2.946D 00	9.446D-01	1.026D 00	8.191D-01	1.570D-01	0.0
4.00D 02	2.921D 00	9.289D-01	1.008D 00	8.254D-01	1.587D-01	0.0
4.10D 02	2.895D 00	9.137D-01	9.909D-01	8.310D-01	1.597D-01	0.0
4.20D 02	2.871D 00	8.991D-01	9.746D-01	8.362D-01	1.606D-01	0.0
4.30D 02	2.846D 00	8.849D-01	9.588D-01	8.410D-01	1.615D-01	0.0
4.40D 02	2.823D 00	8.713D-01	9.435D-01	8.454D-01	1.624D-01	0.0
4.50D 02	2.800D 00	8.581D-01	9.289D-01	8.494D-01	1.631D-01	0.0
4.60D 02	2.777D 00	8.454D-01	9.147D-01	8.531D-01	1.639D-01	0.0
4.70D 02	2.755D 00	8.331D-01	9.009D-01	8.560D-01	1.645D-01	0.0
4.80D 02	2.732D 00	8.211D-01	8.877D-01	8.584D-01	1.652D-01	0.0
4.90D 02	2.711D 00	8.096D-01	8.748D-01	8.608D-01	1.658D-01	0.0
5.00D 02	2.690D 00	7.984D-01	8.624D-01	8.630D-01	1.663D-01	0.0

ELECTRON ENERGY EV	STOPPING POWER EV/A	INDIVIDUAL CONTRIBUTIONS TO THE STOPPING POWER IN UNITS OF EV/A				
		EL-EL	PLASMON	AL(2P)	AL(2S)	AL(1S)
5.10D 02	2.670D 00	7.875D-01	8.503D-01	8.650D-01	1.669D-01	0.0
5.20D 02	2.650D 00	7.769D-01	8.396D-01	8.669D-01	1.674D-01	0.0
5.30D 02	2.630D 00	7.667D-01	8.273D-01	8.686D-01	1.678D-01	0.0
5.40D 02	2.610D 00	7.568D-01	8.163D-01	8.693D-01	1.679D-01	0.0
5.50D 02	2.590D 00	7.471D-01	8.055D-01	8.696D-01	1.678D-01	0.0
5.60D 02	2.570D 00	7.377D-01	7.952D-01	8.699D-01	1.677D-01	0.0
5.70D 02	2.551D 00	7.286D-01	7.851D-01	8.700D-01	1.676D-01	0.0
5.80D 02	2.533D 00	7.197D-01	7.753D-01	8.701D-01	1.675D-01	0.0
5.90D 02	2.514D 00	7.110D-01	7.657D-01	8.702D-01	1.674D-01	0.0
6.00D 02	2.496D 00	7.026D-01	7.564D-01	8.701D-01	1.672D-01	0.0
6.10D 02	2.479D 00	6.944D-01	7.474D-01	8.701D-01	1.671D-01	0.0
6.20D 02	2.462D 00	6.864D-01	7.386D-01	8.700D-01	1.669D-01	0.0
6.30D 02	2.445D 00	6.786D-01	7.300D-01	8.699D-01	1.668D-01	0.0
6.40D 02	2.429D 00	6.710D-01	7.217D-01	8.697D-01	1.666D-01	0.0
6.50D 02	2.413D 00	6.636D-01	7.135D-01	8.695D-01	1.665D-01	0.0
6.60D 02	2.397D 00	6.563D-01	7.055D-01	8.692D-01	1.663D-01	0.0
6.70D 02	2.382D 00	6.493D-01	6.978D-01	8.686D-01	1.661D-01	0.0
6.80D 02	2.366D 00	6.424D-01	6.902D-01	8.669D-01	1.660D-01	0.0
6.90D 02	2.350D 00	6.356D-01	6.828D-01	8.653D-01	1.658D-01	0.0
7.00D 02	2.334D 00	6.291D-01	6.756D-01	8.637D-01	1.656D-01	0.0
7.10D 02	2.319D 00	6.226D-01	6.685D-01	8.621D-01	1.655D-01	0.0
7.20D 02	2.304D 00	6.163D-01	6.616D-01	8.606D-01	1.653D-01	0.0
7.30D 02	2.289D 00	6.102D-01	6.549D-01	8.591D-01	1.651D-01	0.0
7.40D 02	2.275D 00	6.042D-01	6.484D-01	8.577D-01	1.650D-01	0.0
7.50D 02	2.261D 00	5.983D-01	6.419D-01	8.564D-01	1.648D-01	0.0
7.60D 02	2.248D 00	5.925D-01	6.356D-01	8.548D-01	1.646D-01	0.0
7.70D 02	2.234D 00	5.869D-01	6.294D-01	8.532D-01	1.644D-01	0.0
7.80D 02	2.221D 00	5.814D-01	6.233D-01	8.516D-01	1.643D-01	0.0
7.90D 02	2.207D 00	5.759D-01	6.175D-01	8.499D-01	1.641D-01	0.0
8.00D 02	2.195D 00	5.707D-01	6.117D-01	8.480D-01	1.639D-01	0.0
8.10D 02	2.184D 00	5.655D-01	6.060D-01	8.464D-01	1.636D-01	0.0
8.20D 02	2.171D 00	5.604D-01	6.005D-01	8.446D-01	1.631D-01	0.0
8.30D 02	2.158D 00	5.554D-01	5.950D-01	8.427D-01	1.626D-01	0.0
8.40D 02	2.145D 00	5.505D-01	5.897D-01	8.409D-01	1.621D-01	0.0
8.50D 02	2.133D 00	5.457D-01	5.844D-01	8.390D-01	1.616D-01	0.0
8.60D 02	2.120D 00	5.410D-01	5.793D-01	8.370D-01	1.612D-01	0.0
8.70D 02	2.108D 00	5.364D-01	5.743D-01	8.349D-01	1.607D-01	0.0
8.80D 02	2.096D 00	5.318D-01	5.694D-01	8.328D-01	1.602D-01	0.0
8.90D 02	2.084D 00	5.274D-01	5.645D-01	8.307D-01	1.598D-01	0.0
9.00D 02	2.072D 00	5.230D-01	5.598D-01	8.286D-01	1.593D-01	0.0
9.10D 02	2.060D 00	5.187D-01	5.551D-01	8.264D-01	1.589D-01	0.0
9.20D 02	2.048D 00	5.145D-01	5.505D-01	8.242D-01	1.584D-01	0.0
9.30D 02	2.037D 00	5.104D-01	5.460D-01	8.220D-01	1.580D-01	0.0
9.40D 02	2.025D 00	5.063D-01	5.416D-01	8.199D-01	1.575D-01	0.0
9.50D 02	2.014D 00	5.024D-01	5.372D-01	8.174D-01	1.571D-01	0.0
9.60D 02	2.003D 00	4.984D-01	5.329D-01	8.148D-01	1.567D-01	0.0
9.70D 02	1.992D 00	4.946D-01	5.288D-01	8.123D-01	1.562D-01	0.0
9.80D 02	1.981D 00	4.908D-01	5.247D-01	8.097D-01	1.558D-01	0.0
9.90D 02	1.970D 00	4.871D-01	5.206D-01	8.072D-01	1.554D-01	0.0
1.00D 03	1.960D 00	4.834D-01	5.167D-01	8.046D-01	1.550D-01	0.0
1.05D 03	1.908D 00	4.659D-01	4.977D-01	7.917D-01	1.529D-01	0.0
1.10D 03	1.860D 00	4.498D-01	4.802D-01	7.788D-01	1.507D-01	0.0
1.15D 03	1.814D 00	4.349D-01	4.641D-01	7.660D-01	1.486D-01	0.0

TABLE 1B-STOPPING POWER OF ALUMINUM (DENSITY 2.71G/CM3) FOR ELECTRONS

ELECTRON ENERGY EV	STOPPING POWER EV/A	INDIVIDUAL CONTRIBUTIONS TO THE STOPPING POWER IN UNITS OF EV/A				
		EL-EL	PLASMON	AL(2P)	AL(2S)	AL(1S)
1.20D 03	1.770D 00	4.210D-01	4.490D-01	7.534D-01	1.464D-01	0.0
1.25D 03	1.729D 00	4.081D-01	4.350D-01	7.410D-01	1.443D-01	0.0
1.30D 03	1.690D 00	3.960D-01	4.220D-01	7.289D-01	1.423D-01	0.0
1.35D 03	1.651D 00	3.846D-01	4.097D-01	7.171D-01	1.402D-01	0.0
1.40D 03	1.616D 00	3.740D-01	3.982D-01	7.056D-01	1.382D-01	0.0
1.45D 03	1.582D 00	3.640D-01	3.874D-01	6.943D-01	1.362D-01	0.0
1.50D 03	1.549D 00	3.545D-01	3.772D-01	6.833D-01	1.343D-01	0.0
1.55D 03	1.518D 00	3.456D-01	3.676D-01	6.726D-01	1.325D-01	0.0
1.60D 03	1.489D 00	3.372D-01	3.585D-01	6.621D-01	1.307D-01	6.553D-05
1.65D 03	1.460D 00	3.292D-01	3.499D-01	6.519D-01	1.289D-01	2.460D-04
1.70D 03	1.433D 00	3.216D-01	3.417D-01	6.419D-01	1.272D-01	4.598D-04
1.75D 03	1.407D 00	3.143D-01	3.339D-01	6.321D-01	1.255D-01	6.970D-04
1.80D 03	1.381D 00	3.075D-01	3.265D-01	6.227D-01	1.238D-01	9.515D-04
1.85D 03	1.357D 00	3.009D-01	3.195D-01	6.134D-01	1.221D-01	1.217D-03
1.90D 03	1.334D 00	2.946D-01	3.128D-01	6.045D-01	1.205D-01	1.485D-03
1.95D 03	1.311D 00	2.887D-01	3.064D-01	5.957D-01	1.189D-01	1.752D-03
2.00D 03	1.290D 00	2.829D-01	3.002D-01	5.872D-01	1.174D-01	2.014D-03
2.05D 03	1.269D 00	2.775D-01	2.943D-01	5.789D-01	1.159D-01	2.269D-03
2.10D 03	1.249D 00	2.722D-01	2.887D-01	5.709D-01	1.144D-01	2.517D-03
2.15D 03	1.229D 00	2.672D-01	2.833D-01	5.631D-01	1.129D-01	2.756D-03
2.20D 03	1.211D 00	2.623D-01	2.781D-01	5.555D-01	1.115D-01	3.004D-03
2.25D 03	1.192D 00	2.577D-01	2.732D-01	5.482D-01	1.101D-01	3.253D-03
2.30D 03	1.175D 00	2.532D-01	2.684D-01	5.411D-01	1.088D-01	3.495D-03
2.35D 03	1.158D 00	2.489D-01	2.637D-01	5.341D-01	1.075D-01	3.730D-03
2.40D 03	1.142D 00	2.448D-01	2.592D-01	5.274D-01	1.062D-01	3.960D-03
2.45D 03	1.126D 00	2.408D-01	2.550D-01	5.209D-01	1.049D-01	4.184D-03
2.50D 03	1.111D 00	2.369D-01	2.509D-01	5.146D-01	1.037D-01	4.401D-03
2.55D 03	1.096D 00	2.332D-01	2.469D-01	5.085D-01	1.026D-01	4.612D-03
2.60D 03	1.082D 00	2.296D-01	2.430D-01	5.026D-01	1.014D-01	4.818D-03
2.65D 03	1.068D 00	2.261D-01	2.393D-01	4.969D-01	1.003D-01	5.019D-03
2.70D 03	1.054D 00	2.228D-01	2.357D-01	4.914D-01	9.924D-02	5.214D-03
2.75D 03	1.041D 00	2.195D-01	2.322D-01	4.860D-01	9.820D-02	5.396D-03
2.80D 03	1.029D 00	2.163D-01	2.288D-01	4.808D-01	9.718D-02	5.571D-03
2.85D 03	1.016D 00	2.133D-01	2.255D-01	4.757D-01	9.620D-02	5.742D-03
2.90D 03	1.004D 00	2.103D-01	2.223D-01	4.707D-01	9.525D-02	5.908D-03
2.95D 03	9.929D-01	2.074D-01	2.193D-01	4.658D-01	9.432D-02	6.069D-03
3.00D 03	9.816D-01	2.046D-01	2.163D-01	4.610D-01	9.343D-02	6.226D-03
3.10D 03	9.599D-01	1.993D-01	2.106D-01	4.518D-01	9.171D-02	6.527D-03
3.20D 03	9.394D-01	1.942D-01	2.052D-01	4.430D-01	9.009D-02	6.813D-03
3.30D 03	9.197D-01	1.894D-01	2.001D-01	4.346D-01	8.857D-02	7.077D-03
3.40D 03	9.011D-01	1.849D-01	1.952D-01	4.265D-01	8.713D-02	7.321D-03
3.50D 03	8.832D-01	1.806D-01	1.906D-01	4.187D-01	8.578D-02	7.551D-03
3.60D 03	8.662D-01	1.765D-01	1.863D-01	4.112D-01	8.450D-02	7.769D-03
3.70D 03	8.500D-01	1.726D-01	1.821D-01	4.040D-01	8.329D-02	7.974D-03
3.80D 03	8.345D-01	1.689D-01	1.782D-01	3.971D-01	8.215D-02	8.168D-03
3.90D 03	8.196D-01	1.653D-01	1.744D-01	3.904D-01	8.107D-02	8.353D-03
4.00D 03	8.053D-01	1.620D-01	1.708D-01	3.840D-01	8.005D-02	8.528D-03
4.10D 03	7.916D-01	1.587D-01	1.674D-01	3.777D-01	7.909D-02	8.690D-03
4.20D 03	7.784D-01	1.556D-01	1.640D-01	3.718D-01	7.816D-02	8.832D-03
4.30D 03	7.657D-01	1.526D-01	1.608D-01	3.660D-01	7.726D-02	8.966D-03
4.40D 03	7.534D-01	1.498D-01	1.578D-01	3.604D-01	7.637D-02	9.092D-03
4.50D 03	7.416D-01	1.470D-01	1.549D-01	3.549D-01	7.549D-02	9.210D-03
4.60D 03	7.302D-01	1.444D-01	1.521D-01	3.497D-01	7.464D-02	9.323D-03

ELECTRON ENERGY EV	STOPPING POWER EV/A	INDIVIDUAL CONTRIBUTIONS TO THE STOPPING POWER IN UNITS OF EV/A				
		EL-EL	PLASMON	AL(2P)	AL(2S)	AL(1S)
4.70D 03	7.192D-01	1.419D-01	1.494D-01	3.446D-01	7.[illegible]30D-02	9.423D-03
4.80D 03	7.085D-01	1.394D-01	1.469D-01	3.397D-01	7.[illegible]98D-02	9.496D-03
4.90D 03	6.982D-01	1.371D-01	1.444D-01	3.349D-01	7.217D-02	9.560D-03
5.00D 03	6.881D-01	1.348D-01	1.420D-01	3.303D-01	7.138D-02	9.632D-03
5.10D 03	6.784D-01	1.326D-01	1.396D-01	3.258D-01	7.061D-02	9.667D-03
5.20D 03	6.690D-01	1.305D-01	1.374D-01	3.214D-01	6.985D-02	9.712D-03
5.30D 03	6.599D-01	1.285D-01	1.352D-01	3.172D-01	6.910D-02	9.753D-03
5.40D 03	6.510D-01	1.265D-01	1.331D-01	3.131D-01	6.837D-02	9.789D-03
5.50D 03	6.421D-01	1.246D-01	1.310D-01	3.091D-01	6.766D-02	9.821D-03
5.60D 03	6.338D-01	1.228D-01	1.291D-01	3.052D-01	6.697D-02	9.849D-03
5.70D 03	6.257D-01	1.210D-01	1.272D-01	3.014D-01	6.629D-02	9.874D-03
5.80D 03	6.178D-01	1.192D-01	1.254D-01	2.977D-01	6.562D-02	9.898D-03
5.90D 03	6.102D-01	1.175D-01	1.236D-01	2.941D-01	6.497D-02	9.917D-03
6.00D 03	6.027D-01	1.159D-01	1.219D-01	2.906D-01	6.434D-02	9.934D-03
6.10D 03	5.955D-01	1.143D-01	1.202D-01	2.872D-01	6.371D-02	9.949D-03
6.20D 03	5.884D-01	1.128D-01	1.186D-01	2.839D-01	6.310D-02	9.962D-03
6.30D 03	5.815D-01	1.113D-01	1.170D-01	2.807D-01	6.251D-02	9.972D-03
6.40D 03	5.748D-01	1.099D-01	1.155D-01	2.776D-01	6.192D-02	9.979D-03
6.50D 03	5.682D-01	1.084D-01	1.140D-01	2.745D-01	6.134D-02	9.984D-03
6.60D 03	5.618D-01	1.071D-01	1.125D-01	2.715D-01	6.078D-02	9.985D-03
6.70D 03	5.556D-01	1.057D-01	1.111D-01	2.686D-01	6.022D-02	9.985D-03
6.80D 03	5.495D-01	1.044D-01	1.097D-01	2.657D-01	5.967D-02	9.983D-03
6.90D 03	5.436D-01	1.032D-01	1.084D-01	2.629D-01	5.914D-02	9.978D-03
7.00D 03	5.378D-01	1.019D-01	1.071D-01	2.602D-01	5.860D-02	9.972D-03
7.10D 03	5.321D-01	1.007D-01	1.058D-01	2.576D-01	5.808D-02	9.964D-03
7.20D 03	5.266D-01	9.956D-02	1.045D-01	2.550D-01	5.757D-02	9.955D-03
7.30D 03	5.211D-01	9.842D-02	1.033D-01	2.524D-01	5.706D-02	9.944D-03
7.40D 03	5.159D-01	9.730D-02	1.021D-01	2.499D-01	5.656D-02	9.932D-03
7.50D 03	5.107D-01	9.622D-02	1.010D-01	2.475D-01	5.607D-02	9.919D-03
7.60D 03	5.056D-01	9.515D-02	9.988D-02	2.451D-01	5.558D-02	9.905D-03
7.70D 03	5.007D-01	9.412D-02	9.880D-02	2.428D-01	5.510D-02	9.889D-03
7.80D 03	4.958D-01	9.310D-02	9.774D-02	2.405D-01	5.463D-02	9.873D-03
7.90D 03	4.911D-01	9.211D-02	9.670D-02	2.383D-01	5.417D-02	9.856D-03
8.00D 03	4.865D-01	9.115D-02	9.568D-02	2.361D-01	5.371D-02	9.838D-03
8.10D 03	4.819D-01	9.020D-02	9.468D-02	2.339D-01	5.326D-02	9.820D-03
8.20D 03	4.774D-01	8.928D-02	9.371D-02	2.318D-01	5.282D-02	9.800D-03
8.30D 03	4.731D-01	8.837D-02	9.275D-02	2.298D-01	5.239D-02	9.781D-03
8.40D 03	4.688D-01	8.749D-02	9.182D-02	2.277D-01	5.196D-02	9.760D-03
8.50D 03	4.646D-01	8.662D-02	9.091D-02	2.258D-01	5.155D-02	9.739D-03
8.60D 03	4.605D-01	8.577D-02	9.001D-02	2.238D-01	5.113D-02	9.717D-03
8.70D 03	4.564D-01	8.494D-02	8.913D-02	2.219D-01	5.073D-02	9.694D-03
8.80D 03	4.524D-01	8.413D-02	8.827D-02	2.200D-01	5.033D-02	9.671D-03
8.90D 03	4.486D-01	8.333D-02	8.742D-02	2.182D-01	4.994D-02	9.647D-03
9.00D 03	4.447D-01	8.255D-02	8.659D-02	2.164D-01	4.956D-02	9.622D-03
9.10D 03	4.410D-01	8.179D-02	8.578D-02	2.146D-01	4.918D-02	9.597D-03
9.20D 03	4.373D-01	8.104D-02	8.499D-02	2.129D-01	4.881D-02	9.572D-03
9.30D 03	4.337D-01	8.030D-02	8.421D-02	2.112D-01	4.845D-02	9.546D-03
9.40D 03	4.301D-01	7.958D-02	8.344D-02	2.095D-01	4.809D-02	9.520D-03
9.50D 03	4.267D-01	7.887D-02	8.269D-02	2.079D-01	4.774D-02	9.494D-03
9.60D 03	4.232D-01	7.818D-02	8.195D-02	2.063D-01	4.739D-02	9.467D-03
9.70D 03	4.199D-01	7.750D-02	8.122D-02	2.047D-01	4.705D-02	9.440D-03
9.80D 03	4.166D-01	7.683D-02	8.051D-02	2.031D-01	4.671D-02	9.413D-03
9.90D 03	4.133D-01	7.617D-02	7.981D-02	2.016D-01	4.638D-02	9.386D-03
1.00D 04	4.101D-01	7.553D-02	7.912D-02	2.000D-01	4.605D-02	9.359D-03

TABLE 1C-CSDA RANGE AND STRAGGLING OF ELECTRONS IN ALUMINUM (DENSITY 2.71G/CM3)

ELECTRON ENERGY EV	CSDA RANGE (E TO 10EV) A	MEAN SQUARE ENERGY LOSS EV2/A	MEAN SQUARE RANGE FLUCTUATION A2	RELATIVE RANGE STRAGGLING
1.10D 01	1.167D 01	3.842D-01	5.149D 02	1.945D 00
1.20D 01	2.096D 01	5.246D-01	8.759D 02	1.412D 00
1.30D 01	2.851D 01	6.987D-01	1.136D 03	1.182D 00
1.40D 01	3.474D 01	9.110D-01	1.329D 03	1.050D 00
1.50D 01	3.995D 01	1.166D 00	1.476D 03	9.616D-01
1.60D 01	4.437D 01	1.423D 00	1.587D 03	8.979D-01
1.70D 01	4.814D 01	1.716D 00	1.671D 03	8.491D-01
1.80D 01	5.143D 01	2.047D 00	1.738D 03	8.105D-01
1.90D 01	5.437D 01	2.418D 00	1.794D 03	7.791D-01
2.00D 01	5.700D 01	2.834D 00	1.842D 03	7.529D-01
2.10D 01	5.936D 01	3.297D 00	1.882D 03	7.308D-01
2.20D 01	6.177D 01	3.812D 00	1.914D 03	7.083D-01
2.30D 01	6.305D 01	1.770D 01	1.934D 03	6.975D-01
2.40D 01	6.377D 01	2.794D 01	1.943D 03	6.912D-01
2.50D 01	6.431D 01	3.401D 01	1.948D 03	6.863D-01
2.60D 01	6.478D 01	3.866D 01	1.951D 03	6.819D-01
2.70D 01	6.520D 01	4.251D 01	1.954D 03	6.781D-01
2.80D 01	6.559D 01	4.583D 01	1.957D 03	6.745D-01
2.90D 01	6.595D 01	4.877D 01	1.959D 03	6.712D-01
3.00D 01	6.629D 01	5.143D 01	1.961D 03	6.681D-01
3.20D 01	6.692D 01	5.616D 01	1.965D 03	6.624D-01
3.40D 01	6.751D 01	6.031D 01	1.968D 03	6.571D-01
3.60D 01	6.806D 01	6.402D 01	1.970D 03	6.522D-01
3.80D 01	6.859D 01	6.736D 01	1.973D 03	6.476D-01
4.00D 01	6.910D 01	7.039D 01	1.975D 03	6.431D-01
4.20D 01	6.959D 01	7.315D 01	1.977D 03	6.389D-01
4.40D 01	7.008D 01	7.566D 01	1.979D 03	6.348D-01
4.60D 01	7.056D 01	7.795D 01	1.981D 03	6.309D-01
4.80D 01	7.103D 01	8.024D 01	1.983D 03	6.270D-01
5.00D 01	7.149D 01	8.253D 01	1.985D 03	6.233D-01
5.20D 01	7.195D 01	8.446D 01	1.987D 03	6.196D-01
5.40D 01	7.240D 01	8.619D 01	1.989D 03	6.160D-01
5.60D 01	7.285D 01	8.771D 01	1.991D 03	6.125D-01
5.80D 01	7.330D 01	8.904D 01	1.993D 03	6.091D-01
6.00D 01	7.374D 01	9.018D 01	1.995D 03	6.057D-01
6.20D 01	7.419D 01	9.116D 01	1.997D 03	6.024D-01
6.40D 01	7.463D 01	9.200D 01	1.999D 03	5.991D-01
6.60D 01	7.508D 01	9.271D 01	2.001D 03	5.959D-01
6.80D 01	7.552D 01	9.332D 01	2.003D 03	5.927D-01
7.00D 01	7.597D 01	9.384D 01	2.005D 03	5.895D-01
7.20D 01	7.641D 01	9.427D 01	2.008D 03	5.864D-01
7.40D 01	7.686D 01	9.463D 01	2.010D 03	5.833D-01
7.60D 01	7.731D 01	9.492D 01	2.012D 03	5.802D-01
7.80D 01	7.776D 01	9.516D 01	2.014D 03	5.771D-01
8.00D 01	7.822D 01	9.535D 01	2.016D 03	5.741D-01
8.20D 01	7.867D 01	9.549D 01	2.019D 03	5.711D-01
8.40D 01	7.913D 01	9.559D 01	2.021D 03	5.681D-01
8.60D 01	7.959D 01	9.566D 01	2.023D 03	5.651D-01
8.80D 01	8.006D 01	9.570D 01	2.026D 03	5.622D-01
9.00D 01	8.052D 01	9.571D 01	2.028D 03	5.593D-01
9.20D 01	8.099D 01	9.569D 01	2.030D 03	5.564D-01

TABLE 1C-CSDA RANGE AND STRAGGLING OF ELECTRONS IN ALUMINUM

ELECTRON ENERGY EV	CSDA RANGE (E TO 10EV) A	MEAN SQUARE ENERGY LOSS EV2/A	MEAN SQUARE RANGE FLUCTUATION A2	RELATIVE RANGE STRAGGLING
9.40D 01	8.147D 01	9.639D 01	2.033D 03	5.535D-01
9.60D 01	8.194D 01	9.735D 01	2.036D 03	5.506D-01
9.80D 01	8.242D 01	9.834D 01	2.038D 03	5.478D-01
1.00D 02	8.290D 01	9.936D 01	2.041D 03	5.450D-01
1.10D 02	8.532D 01	1.045D 02	2.055D 03	5.314D-01
1.20D 02	8.778D 01	1.095D 02	2.072D 03	5.185D-01
1.30D 02	9.030D 01	1.148D 02	2.089D 03	5.062D-01
1.40D 02	9.286D 01	1.214D 02	2.109D 03	4.946D-01
1.50D 02	9.546D 01	1.281D 02	2.131D 03	4.836D-01
1.60D 02	9.809D 01	1.345D 02	2.155D 03	4.733D-01
1.70D 02	1.008D 02	1.406D 02	2.181D 03	4.635D-01
1.80D 02	1.035D 02	1.463D 02	2.210D 03	4.543D-01
1.90D 02	1.062D 02	1.517D 02	2.241D 03	4.456D-01
2.00D 02	1.090D 02	1.574D 02	2.274D 03	4.375D-01
2.10D 02	1.118D 02	1.632D 02	2.310D 03	4.298D-01
2.20D 02	1.147D 02	1.687D 02	2.349D 03	4.226D-01
2.30D 02	1.176D 02	1.742D 02	2.390D 03	4.158D-01
2.40D 02	1.205D 02	1.794D 02	2.434D 03	4.095D-01
2.50D 02	1.234D 02	1.844D 02	2.480D 03	4.035D-01
2.60D 02	1.264D 02	1.893D 02	2.529D 03	3.979D-01
2.70D 02	1.294D 02	1.935D 02	2.581D 03	3.926D-01
2.80D 02	1.324D 02	1.976D 02	2.635D 03	3.877D-01
2.90D 02	1.355D 02	2.015D 02	2.694D 03	3.830D-01
3.00D 02	1.386D 02	2.053D 02	2.755D 03	3.786D-01
3.10D 02	1.418D 02	2.090D 02	2.819D 03	3.745D-01
3.20D 02	1.449D 02	2.126D 02	2.886D 03	3.707D-01
3.30D 02	1.481D 02	2.160D 02	2.956D 03	3.670D-01
3.40D 02	1.514D 02	2.193D 02	3.029D 03	3.636D-01
3.50D 02	1.546D 02	2.224D 02	3.106D 03	3.604D-01
3.60D 02	1.579D 02	2.254D 02	3.185D 03	3.574D-01
3.70D 02	1.612D 02	2.284D 02	3.268D 03	3.546D-01
3.80D 02	1.646D 02	2.313D 02	3.355D 03	3.520D-01
3.90D 02	1.679D 02	2.341D 02	3.445D 03	3.495D-01
4.00D 02	1.714D 02	2.367D 02	3.538D 03	3.471D-01
4.10D 02	1.748D 02	2.391D 02	3.635D 03	3.449D-01
4.20D 02	1.783D 02	2.414D 02	3.735D 03	3.428D-01
4.30D 02	1.818D 02	2.437D 02	3.839D 03	3.409D-01
4.40D 02	1.853D 02	2.459D 02	3.946D 03	3.390D-01
4.50D 02	1.888D 02	2.481D 02	4.057D 03	3.373D-01
4.60D 02	1.924D 02	2.502D 02	4.172D 03	3.357D-01
4.70D 02	1.961D 02	2.522D 02	4.291D 03	3.341D-01
4.80D 02	1.997D 02	2.541D 02	4.414D 03	3.327D-01
4.90D 02	2.034D 02	2.559D 02	4.540D 03	3.313D-01
5.00D 02	2.071D 02	2.577D 02	4.671D 03	3.300D-01
5.10D 02	2.108D 02	2.595D 02	4.805D 03	3.288D-01
5.20D 02	2.146D 02	2.613D 02	4.944D 03	3.277D-01
5.30D 02	2.184D 02	2.631D 02	5.086D 03	3.266D-01
5.40D 02	2.222D 02	2.645D 02	5.233D 03	3.256D-01
5.50D 02	2.260D 02	2.659D 02	5.384D 03	3.246D-01
5.60D 02	2.299D 02	2.673D 02	5.539D 03	3.237D-01
5.70D 02	2.338D 02	2.686D 02	5.698D 03	3.229D-01

TABLE 1C-CSDA RANGE AND STRAGGLING OF ELECTRONS IN ALUMINUM (DENSITY 2.71G/CM3)

ELECTRON ENERGY EV	CSDA RANGE (E TO 10EV) A	MEAN SQUARE ENERGY LOSS EV2/A	MEAN SQUARE RANGE FLUCTUATION A2	RELATIVE RANGE STRAGGLING
5.80D 02	2.377D 02	2.699D 02	5.862D 03	3.221D-01
5.90D 02	2.417D 02	2.712D 02	6.031D 03	3.213D-01
6.00D 02	2.457D 02	2.725D 02	6.203D 03	3.206D-01
6.10D 02	2.497D 02	2.737D 02	6.381D 03	3.199D-01
6.20D 02	2.538D 02	2.750D 02	6.563D 03	3.193D-01
6.30D 02	2.578D 02	2.762D 02	6.749D 03	3.186D-01
6.40D 02	2.619D 02	2.774D 02	6.941D 03	3.181D-01
6.50D 02	2.661D 02	2.786D 02	7.137D 03	3.175D-01
6.60D 02	2.702D 02	2.798D 02	7.337D 03	3.170D-01
6.70D 02	2.744D 02	2.809D 02	7.543D 03	3.165D-01
6.80D 02	2.786D 02	2.817D 02	7.753D 03	3.160D-01
6.90D 02	2.829D 02	2.825D 02	7.968D 03	3.156D-01
7.00D 02	2.871D 02	2.834D 02	8.189D 03	3.152D-01
7.10D 02	2.914D 02	2.842D 02	8.414D 03	3.148D-01
7.20D 02	2.958D 02	2.850D 02	8.645D 03	3.144D-01
7.30D 02	3.001D 02	2.858D 02	8.880D 03	3.140D-01
7.40D 02	3.045D 02	2.866D 02	9.121D 03	3.137D-01
7.50D 02	3.089D 02	2.874D 02	9.367D 03	3.133D-01
7.60D 02	3.133D 02	2.882D 02	9.618D 03	3.130D-01
7.70D 02	3.178D 02	2.889D 02	9.875D 03	3.127D-01
7.80D 02	3.223D 02	2.896D 02	1.014D 04	3.124D-01
7.90D 02	3.268D 02	2.903D 02	1.040D 04	3.121D-01
8.00D 02	3.313D 02	2.910D 02	1.068D 04	3.118D-01
8.10D 02	3.359D 02	2.912D 02	1.095D 04	3.116D-01
8.20D 02	3.405D 02	2.918D 02	1.124D 04	3.113D-01
8.30D 02	3.451D 02	2.924D 02	1.152D 04	3.110D-01
8.40D 02	3.498D 02	2.929D 02	1.182D 04	3.108D-01
8.50D 02	3.545D 02	2.934D 02	1.212D 04	3.106D-01
8.60D 02	3.592D 02	2.939D 02	1.242D 04	3.103D-01
8.70D 02	3.639D 02	2.944D 02	1.273D 04	3.101D-01
8.80D 02	3.686D 02	2.948D 02	1.305D 04	3.099D-01
8.90D 02	3.734D 02	2.952D 02	1.337D 04	3.097D-01
9.00D 02	3.782D 02	2.956D 02	1.370D 04	3.095D-01
9.10D 02	3.831D 02	2.960D 02	1.404D 04	3.093D-01
9.20D 02	3.879D 02	2.964D 02	1.438D 04	3.091D-01
9.30D 02	3.928D 02	2.967D 02	1.473D 04	3.089D-01
9.40D 02	3.978D 02	2.970D 02	1.508D 04	3.088D-01
9.50D 02	4.027D 02	2.973D 02	1.544D 04	3.086D-01
9.60D 02	4.077D 02	2.976D 02	1.581D 04	3.084D-01
9.70D 02	4.127D 02	2.979D 02	1.619D 04	3.083D-01
9.80D 02	4.177D 02	2.981D 02	1.657D 04	3.081D-01
9.90D 02	4.228D 02	2.984D 02	1.695D 04	3.079D-01
1.00D 03	4.279D 02	2.986D 02	1.735D 04	3.078D-01
1.05D 03	4.537D 02	2.995D 02	1.941D 04	3.071D-01
1.10D 03	4.803D 02	3.001D 02	2.166D 04	3.064D-01
1.15D 03	5.075D 02	3.004D 02	2.408D 04	3.058D-01
1.20D 03	5.354D 02	3.006D 02	2.670D 04	3.052D-01
1.25D 03	5.640D 02	3.006D 02	2.951D 04	3.045D-01
1.30D 03	5.933D 02	3.006D 02	3.252D 04	3.039D-01
1.35D 03	6.232D 02	3.002D 02	3.574D 04	3.034D-01
1.40D 03	6.538D 02	2.999D 02	3.918D 04	3.028D-01

TABLE 1C-CSDA RANGE AND STRAGGLING OF ELECTRONS IN ALUMINUM (DENSITY 2.71G/CM3)

ELECTRON ENERGY EV	CSDA RANGE (E TO 10EV) A	MEAN SQUARE ENERGY LOSS EV2/A	MEAN SQUARE RANGE FLUCTUATION A2	RELATIVE RANGE STRAGGLING
1.45D 03	6.851D 02	2.996D 02	4.285D 04	3.022D-01
1.50D 03	7.170D 02	2.992D 02	4.675D 04	3.016D-01
1.55D 03	7.496D 02	2.986D 02	5.090D 04	3.010D-01
1.60D 03	7.829D 02	2.982D 02	5.529D 04	3.003D-01
1.65D 03	8.168D 02	2.978D 02	5.994D 04	2.997D-01
1.70D 03	8.514D 02	2.974D 02	6.486D 04	2.991D-01
1.75D 03	8.866D 02	2.970D 02	7.006D 04	2.985D-01
1.80D 03	9.225D 02	2.966D 02	7.554D 04	2.979D-01
1.85D 03	9.590D 02	2.962D 02	8.131D 04	2.973D-01
1.90D 03	9.962D 02	2.957D 02	8.739D 04	2.968D-01
1.95D 03	1.034D 03	2.952D 02	9.377D 04	2.962D-01
2.00D 03	1.072D 03	2.947D 02	1.005D 05	2.956D-01
2.05D 03	1.111D 03	2.942D 02	1.075D 05	2.950D-01
2.10D 03	1.151D 03	2.936D 02	1.149D 05	2.944D-01
2.15D 03	1.192D 03	2.931D 02	1.226D 05	2.938D-01
2.20D 03	1.233D 03	2.925D 02	1.307D 05	2.933D-01
2.25D 03	1.274D 03	2.919D 02	1.391D 05	2.927D-01
2.30D 03	1.316D 03	2.914D 02	1.479D 05	2.921D-01
2.35D 03	1.359D 03	2.909D 02	1.571D 05	2.916D-01
2.40D 03	1.403D 03	2.903D 02	1.666D 05	2.910D-01
2.45D 03	1.447D 03	2.898D 02	1.766D 05	2.904D-01
2.50D 03	1.492D 03	2.893D 02	1.869D 05	2.899D-01
2.55D 03	1.537D 03	2.888D 02	1.977D 05	2.893D-01
2.60D 03	1.583D 03	2.884D 02	2.089D 05	2.887D-01
2.65D 03	1.629D 03	2.880D 02	2.205D 05	2.882D-01
2.70D 03	1.677D 03	2.876D 02	2.325D 05	2.876D-01
2.75D 03	1.724D 03	2.872D 02	2.450D 05	2.871D-01
2.80D 03	1.773D 03	2.869D 02	2.580D 05	2.865D-01
2.85D 03	1.821D 03	2.865D 02	2.714D 05	2.860D-01
2.90D 03	1.871D 03	2.863D 02	2.853D 05	2.855D-01
2.95D 03	1.921D 03	2.860D 02	2.996D 05	2.850D-01
3.00D 03	1.972D 03	2.858D 02	3.145D 05	2.844D-01
3.10D 03	2.075D 03	2.854D 02	3.457D 05	2.834D-01
3.20D 03	2.180D 03	2.851D 02	3.791D 05	2.824D-01
3.30D 03	2.288D 03	2.849D 02	4.146D 05	2.815D-01
3.40D 03	2.397D 03	2.847D 02	4.523D 05	2.805D-01
3.50D 03	2.510D 03	2.845D 02	4.924D 05	2.796D-01
3.60D 03	2.624D 03	2.844D 02	5.349D 05	2.787D-01
3.70D 03	2.740D 03	2.844D 02	5.800D 05	2.779D-01
3.80D 03	2.859D 03	2.844D 02	6.276D 05	2.771D-01
3.90D 03	2.980D 03	2.843D 02	6.779D 05	2.763D-01
4.00D 03	3.103D 03	2.843D 02	7.309D 05	2.755D-01
4.10D 03	3.228D 03	2.843D 02	7.868D 05	2.747D-01
4.20D 03	3.356D 03	2.843D 02	8.456D 05	2.740D-01
4.30D 03	3.485D 03	2.843D 02	9.074D 05	2.733D-01
4.40D 03	3.617D 03	2.843D 02	9.723D 05	2.726D-01
4.50D 03	3.751D 03	2.843D 02	1.040D 06	2.719D-01
4.60D 03	3.887D 03	2.842D 02	1.112D 06	2.713D-01
4.70D 03	4.025D 03	2.841D 02	1.186D 06	2.706D-01
4.80D 03	4.165D 03	2.840D 02	1.265D 06	2.700D-01
4.90D 03	4.307D 03	2.839D 02	1.346D 06	2.694D-01

CSDA RANGE AND STRAGGLING OF ELECTRONS IN ALUMINUM (DENSITY 2.71G/CM3)

ELECTRON ENERGY EV	CSDA RANGE (E TO 10EV) A	MEAN SQUARE ENERGY LOSS EV2/A	MEAN SQUARE RANGE FLUCTUATION A2	RELATIVE RANGE STRAGGLING
5.00D 03	4.451D 03	2.837D 02	1.431D 06	2.688D-01
5.10D 03	4.598D 03	2.835D 02	1.520D 06	2.682D-01
5.20D 03	4.746D 03	2.833D 02	1.613D 06	2.676D-01
5.30D 03	4.897D 03	2.831D 02	1.710D 06	2.670D-01
5.40D 03	5.049D 03	2.829D 02	1.810D 06	2.665D-01
5.50D 03	5.204D 03	2.820D 02	1.915D 06	2.659D-01
5.60D 03	5.361D 03	2.817D 02	2.023D 06	2.653D-01
5.70D 03	5.519D 03	2.814D 02	2.136D 06	2.648D-01
5.80D 03	5.680D 03	2.811D 02	2.253D 06	2.642D-01
5.90D 03	5.843D 03	2.808D 02	2.374D 06	2.637D-01
6.00D 03	6.008D 03	2.805D 02	2.500D 06	2.632D-01
6.10D 03	6.175D 03	2.802D 02	2.631D 06	2.627D-01
6.20D 03	6.344D 03	2.799D 02	2.766D 06	2.621D-01
6.30D 03	6.515D 03	2.796D 02	2.906D 06	2.616D-01
6.40D 03	6.688D 03	2.793D 02	3.050D 06	2.611D-01
6.50D 03	6.863D 03	2.790D 02	3.200D 06	2.606D-01
6.60D 03	7.040D 03	2.786D 02	3.354D 06	2.602D-01
6.70D 03	7.219D 03	2.783D 02	3.514D 06	2.597D-01
6.80D 03	7.400D 03	2.779D 02	3.679D 06	2.592D-01
6.90D 03	7.583D 03	2.776D 02	3.849D 06	2.587D-01
7.00D 03	7.768D 03	2.772D 02	4.025D 06	2.583D-01
7.10D 03	7.955D 03	2.768D 02	4.206D 06	2.578D-01
7.20D 03	8.144D 03	2.764D 02	4.392D 06	2.573D-01
7.30D 03	8.335D 03	2.760D 02	4.584D 06	2.569D-01
7.40D 03	8.527D 03	2.756D 02	4.782D 06	2.564D-01
7.50D 03	8.722D 03	2.752D 02	4.986D 06	2.560D-01
7.60D 03	8.919D 03	2.748D 02	5.195D 06	2.556D-01
7.70D 03	9.118D 03	2.744D 02	5.411D 06	2.551D-01
7.80D 03	9.318D 03	2.740D 02	5.633D 06	2.547D-01
7.90D 03	9.521D 03	2.735D 02	5.861D 06	2.543D-01
8.00D 03	9.726D 03	2.731D 02	6.095D 06	2.538D-01
8.10D 03	9.932D 03	2.727D 02	6.335D 06	2.534D-01
8.20D 03	1.014D 04	2.722D 02	6.582D 06	2.530D-01
8.30D 03	1.035D 04	2.718D 02	6.835D 06	2.526D-01
8.40D 03	1.056D 04	2.714D 02	7.096D 06	2.522D-01
8.50D 03	1.078D 04	2.710D 02	7.362D 06	2.518D-01
8.60D 03	1.099D 04	2.706D 02	7.636D 06	2.513D-01
8.70D 03	1.121D 04	2.702D 02	7.917D 06	2.509D-01
8.80D 03	1.143D 04	2.698D 02	8.204D 06	2.505D-01
8.90D 03	1.165D 04	2.694D 02	8.499D 06	2.502D-01
9.00D 03	1.188D 04	2.690D 02	8.801D 06	2.498D-01
9.10D 03	1.210D 04	2.686D 02	9.111D 06	2.494D-01
9.20D 03	1.233D 04	2.682D 02	9.428D 06	2.490D-01
9.30D 03	1.256D 04	2.678D 02	9.752D 06	2.486D-01
9.40D 03	1.279D 04	2.674D 02	1.008D 07	2.482D-01
9.50D 03	1.303D 04	2.670D 02	1.042D 07	2.479D-01
9.60D 03	1.326D 04	2.667D 02	1.077D 07	2.475D-01
9.70D 03	1.350D 04	2.663D 02	1.113D 07	2.471D-01
9.80D 03	1.374D 04	2.659D 02	1.149D 07	2.468D-01
9.90D 03	1.398D 04	2.656D 02	1.186D 07	2.464D-01
1.00D 04	1.422D 04	2.652D 02	1.224D 07	2.460D-01

IX. ALUMINUM OXIDE: EXPLANATION OF TABLES

GENERAL NOTES:

1. Electron energies are measured from the bottom of the conduction band.
2. The density of solid Al_2O_3 is taken to be 4.05 g/cm^3.
3. The computer-printed units are translated as:

EV ..... eV	A ..... Å
EV2 ..... $(eV)^2$	A-1 ..... $Å^{-1}$
G/CM3 ..... g/cm^3	A2 ..... $Å^2$
AL203 ..... Al_2O_3	

4. The numerical print-out is in the form, e.g., 2.8D-2 ≡ 2.8×10^{-2}.

TABLE 2A - INVERSE MEAN FREE PATH OF ELECTRONS IN Al_2O_3

VAL (9 EV)	$\mu_{(9\ eV)}$ as given by Eq. (30) + (2) + (20) + (25)
VAL (29 EV)	$\mu_{(29\ eV)}$ as given by Eq. (30) + (2) + (20) + (25)
AL($n\ell$)	$\mu_{n\ell}^{Al,Al_2O_3}$ as given by Eq. (30) + (19)
O(1S)	μ_{1s}^{O,Al_2O_3} as given by Eq. (30) + (19)
INVERSE MFP	μ - total inverse mean free path = sum of individual contributions.

TABLE 2B - STOPPING POWER OF ALUMINUM OXIDE FOR ELECTRONS

VAL (9 EV)	$S_{(9\ eV)}$ as given by Eq. (31) +(2) +(20) +(25)
VAL (29 EV)	$S_{(29\ eV)}$ as given by Eq. (31) +(2) +(20) +(25)
AL($n\ell$)	$S_{n\ell}^{Al,Al_2O_3}$ as given by Eq. (31) +(19)
O(1S)	S_{1s}^{O,Al_2O_3} as given by Eq. (31) +(19)
STOPPING POWER	S - total stopping power = sum of individual contributions.

TABLE 2C - CSDA RANGE AND STRAGGLING OF ELECTRONS IN Al_2O_3

CSDA RANGE (E TO 10 EV)	$R_{(10)}$ - the range of an electron in the continuous-slowing-down approximation in going from an energy E to 10 eV, as given by Eq. (42).
MEAN SQUARE ENERGY LOSS	Ω^2_{exc} - the mean square fluctuation in the energy loss per unit path length, as given by Eqs. (41), (32) +(19), and (32) + (2) +(20) +(25).
MEAN SQUARE RANGE FLUCTUATION	$[\Delta R_{(10)}]^2_{AV}$ - the mean square fluctuation in the range about the mean csda range $R_{(10)}$, as given by Eq. (43).
RELATIVE RANGE STRAGGLING	$\{[\Delta R_{(10)}]^2_{AV}\}^{1/2}/R_{(10)}$

TABLE 2A-INVERSE MEAN FREE PATH OF ELECTRONS IN AL2O3 (DENSITY 4.05G/CM3)

ELECTRON ENERGY EV	INVERSE MFP A-1	INDIVIDUAL CONTRIBUTIONS TO THE INVERSE MFP IN UNITS OF A-1					
		VAL(9EV)	VAL(29EV)	AL(2P)	AL(2S)	O(1S)	AL(1S)
5.0CD-01	0.0	0.0	0.0	0.0	0.0	0.0	0.0
1.0CD 00	0.0	0.0	0.0	0.0	0.0	0.0	0.0
2.0CD 00	0.0	0.0	0.0	0.0	0.0	0.0	0.0
3.0CD 00	0.0	0.0	0.0	0.0	0.0	0.0	0.0
4.00D 00	0.0	0.0	0.0	0.0	0.0	0.0	0.0
5.00D 00	0.0	0.0	0.0	0.0	0.0	0.0	0.0
6.00D 00	0.0	0.0	0.0	0.0	0.0	0.0	0.0
7.0CD 00	0.0	0.0	0.0	0.0	0.0	0.0	0.0
8.00D 00	0.0	0.0	0.0	0.0	0.0	0.0	0.0
9.0CD 00	0.0	0.0	0.0	0.0	0.0	0.0	0.0
1.00D 01	2.356D-03	2.356D-03	0.0	0.0	0.0	0.0	0.0
1.10D 01	6.111D-03	6.111D-03	0.0	0.0	0.0	0.0	0.0
1.20D 01	1.002D-02	1.002D-02	0.0	0.0	0.0	0.0	0.0
1.30D 01	1.392D-02	1.392D-02	0.0	0.0	0.0	0.0	0.0
1.40D 01	1.774D-02	1.774D-02	0.0	0.0	0.0	0.0	0.0
1.50D 01	2.149D-02	2.149D-02	0.0	0.0	0.0	0.0	0.0
1.60D 01	2.522D-02	2.522D-02	0.0	0.0	0.0	0.0	0.0
1.70D 01	2.889D-02	2.889D-02	0.0	0.0	0.0	0.0	0.0
1.80D 01	3.254D-02	3.254D-02	0.0	0.0	0.0	0.0	0.0
1.90D 01	3.616D-02	3.616D-02	0.0	0.0	0.0	0.0	0.0
2.00D 01	3.974D-02	3.974D-02	0.0	0.0	0.0	0.0	0.0
2.10D 01	4.339D-02	4.339D-02	0.0	0.0	0.0	0.0	0.0
2.20D 01	4.698D-02	4.698D-02	0.0	0.0	0.0	0.0	0.0
2.30D 01	5.049D-02	5.049D-02	0.0	0.0	0.0	0.0	0.0
2.40D 01	5.388D-02	5.388D-02	0.0	0.0	0.0	0.0	0.0
2.50D 01	5.713D-02	5.713D-02	0.0	0.0	0.0	0.0	0.0
2.60D 01	6.021D-02	6.021D-02	0.0	0.0	0.0	0.0	0.0
2.70D 01	6.309D-02	6.309D-02	0.0	0.0	0.0	0.0	0.0
2.80D 01	6.576D-02	6.576D-02	0.0	0.0	0.0	0.0	0.0
2.90D 01	6.821D-02	6.820D-02	2.261D-06	0.0	0.0	0.0	0.0
3.00D 01	7.043D-02	7.041D-02	2.011D-05	0.0	0.0	0.0	0.0
3.20D 01	7.791D-02	7.780D-02	1.103D-04	0.0	0.0	0.0	0.0
3.40D 01	8.466D-02	8.440D-02	2.821D-04	0.0	0.0	0.0	0.0
3.60D 01	9.059D-02	9.005D-02	5.365D-04	0.0	0.0	0.0	0.0
3.80D 01	9.561D-02	9.474D-02	8.706D-04	0.0	0.0	0.0	0.0
4.00D 01	9.978D-02	9.850D-02	1.279D-03	0.0	0.0	0.0	0.0
4.20D 01	1.064D-01	1.047D-01	1.755D-03	0.0	0.0	0.0	0.0
4.40D 01	1.122D-01	1.099D-01	2.291D-03	0.0	0.0	0.0	0.0
4.60D 01	1.171D-01	1.142D-01	2.880D-03	0.0	0.0	0.0	0.0
4.80D 01	1.212D-01	1.177D-01	3.516D-03	0.0	0.0	0.0	0.0
5.00D 01	1.246D-01	1.204D-01	4.194D-03	0.0	0.0	0.0	0.0
5.20D 01	1.299D-01	1.250D-01	4.907D-03	0.0	0.0	0.0	0.0
5.40D 01	1.343D-01	1.288D-01	5.650D-03	0.0	0.0	0.0	0.0
5.60D 01	1.385D-01	1.321D-01	6.370D-03	0.0	0.0	0.0	0.0
5.80D 01	1.418D-01	1.348D-01	7.061D-03	0.0	0.0	0.0	0.0
6.00D 01	1.447D-01	1.370D-01	7.724D-03	0.0	0.0	0.0	0.0
6.20D 01	1.482D-01	1.399D-01	8.357D-03	0.0	0.0	0.0	0.0
6.40D 01	1.513D-01	1.423D-01	8.956D-03	0.0	0.0	0.0	0.0
6.60D 01	1.540D-01	1.444D-01	9.519D-03	0.0	0.0	0.0	0.0
6.80D 01	1.563D-01	1.462D-01	1.005D-02	0.0	0.0	0.0	0.0
7.00D 01	1.582D-01	1.477D-01	1.054D-02	0.0	0.0	0.0	0.0
7.20D 01	1.603D-01	1.493D-01	1.099D-02	0.0	0.0	0.0	0.0
7.40D 01	1.621D-01	1.507D-01	1.141D-02	0.0	0.0	0.0	0.0

TABLE 2A-INVERSE MEAN FREE PATH OF ELECTRONS IN AL2O3 (DENSITY 4.05G/CM3)

ELECTRON ENERGY EV	INVERSE MFP A-1	INDIVIDUAL CONTRIBUTIONS TO THE INVERSE MFP IN UNITS OF A-1					
		VAL(9EV)	VAL(29EV)	AL(2P)	AL(2S)	O(1S)	AL(1S)
7.60D 01	1.637D-01	1.519D-01	1.180D-02	0.0	0.0	0.0	0.0
7.80D 01	1.651D-01	1.530D-01	1.216D-02	0.0	0.0	0.0	0.0
8.00D 01	1.666D-01	1.542D-01	1.248D-02	0.0	0.0	0.0	0.0
8.20D 01	1.679D-01	1.551D-01	1.278D-02	3.449D-06	0.0	0.0	0.0
8.40D 01	1.690D-01	1.559D-01	1.305D-02	2.604D-05	0.0	0.0	0.0
8.60D 01	1.701D-01	1.568D-01	1.330D-02	6.589D-05	0.0	0.0	0.0
8.80D 01	1.712D-01	1.575D-01	1.353D-02	1.217D-04	0.0	0.0	0.0
9.00D 01	1.722D-01	1.583D-01	1.373D-02	1.921D-04	0.0	0.0	0.0
9.20D 01	1.730D-01	1.588D-01	1.392D-02	2.745D-04	0.0	0.0	0.0
9.40D 01	1.738D-01	1.593D-01	1.408D-02	3.647D-04	0.0	0.0	0.0
9.60D 01	1.744D-01	1.598D-01	1.423D-02	4.574D-04	0.0	0.0	0.0
9.80D 01	1.750D-01	1.601D-01	1.437D-02	5.532D-04	0.0	0.0	0.0
1.00D 02	1.754D-01	1.603D-01	1.449D-02	6.524D-04	0.0	0.0	0.0
1.10D 02	1.764D-01	1.603D-01	1.502D-02	1.157D-03	0.0	0.0	0.0
1.20D 02	1.762D-01	1.587D-01	1.582D-02	1.636D-03	3.256D-07	0.0	0.0
1.30D 02	1.747D-01	1.562D-01	1.637D-02	2.075D-03	2.926D-05	0.0	0.0
1.40D 02	1.722D-01	1.529D-01	1.676D-02	2.486D-03	8.745D-05	0.0	0.0
1.50D 02	1.689D-01	1.488D-01	1.704D-02	2.893D-03	1.397D-04	0.0	0.0
1.60D 02	1.653D-01	1.447D-01	1.717D-02	3.242D-03	1.924D-04	0.0	0.0
1.70D 02	1.618D-01	1.408D-01	1.726D-02	3.532D-03	2.447D-04	0.0	0.0
1.80D 02	1.584D-01	1.370D-01	1.732D-02	3.768D-03	2.962D-04	0.0	0.0
1.90D 02	1.549D-01	1.333D-01	1.731D-02	3.956D-03	3.464D-04	0.0	0.0
2.00D 02	1.516D-01	1.298D-01	1.726D-02	4.102D-03	3.948D-04	0.0	0.0
2.10D 02	1.484D-01	1.265D-01	1.719D-02	4.255D-03	4.411D-04	0.0	0.0
2.20D 02	1.453D-01	1.233D-01	1.709D-02	4.412D-03	4.849D-04	0.0	0.0
2.30D 02	1.422D-01	1.202D-01	1.697D-02	4.546D-03	5.261D-04	0.0	0.0
2.40D 02	1.394D-01	1.173D-01	1.684D-02	4.657D-03	5.645D-04	0.0	0.0
2.50D 02	1.366D-01	1.145D-01	1.670D-02	4.749D-03	6.003D-04	0.0	0.0
2.60D 02	1.339D-01	1.119D-01	1.655D-02	4.822D-03	6.338D-04	0.0	0.0
2.70D 02	1.313D-01	1.093D-01	1.638D-02	4.877D-03	6.652D-04	0.0	0.0
2.80D 02	1.288D-01	1.069D-01	1.620D-02	4.934D-03	6.815D-04	0.0	0.0
2.90D 02	1.264D-01	1.047D-01	1.603D-02	4.987D-03	6.928D-04	0.0	0.0
3.00D 02	1.241D-01	1.025D-01	1.585D-02	5.032D-03	7.027D-04	0.0	0.0
3.10D 02	1.219D-01	1.004D-01	1.567D-02	5.068D-03	7.112D-04	0.0	0.0
3.20D 02	1.197D-01	9.842D-02	1.550D-02	5.095D-03	7.186D-04	0.0	0.0
3.30D 02	1.177D-01	9.649D-02	1.532D-02	5.112D-03	7.250D-04	0.0	0.0
3.40D 02	1.156D-01	9.463D-02	1.514D-02	5.121D-03	7.305D-04	0.0	0.0
3.50D 02	1.137D-01	9.284D-02	1.497D-02	5.133D-03	7.353D-04	0.0	0.0
3.60D 02	1.118D-01	9.112D-02	1.480D-02	5.142D-03	7.394D-04	0.0	0.0
3.70D 02	1.100D-01	8.947D-02	1.464D-02	5.148D-03	7.429D-04	0.0	0.0
3.80D 02	1.083D-01	8.788D-02	1.450D-02	5.152D-03	7.461D-04	0.0	0.0
3.90D 02	1.066D-01	8.635D-02	1.437D-02	5.152D-03	7.488D-04	0.0	0.0
4.00D 02	1.050D-01	8.488D-02	1.423D-02	5.150D-03	7.512D-04	0.0	0.0
4.10D 02	1.035D-01	8.345D-02	1.410D-02	5.145D-03	7.525D-04	0.0	0.0
4.20D 02	1.019D-01	8.208D-02	1.396D-02	5.137D-03	7.503D-04	0.0	0.0
4.30D 02	1.005D-01	8.076D-02	1.383D-02	5.128D-03	7.480D-04	0.0	0.0
4.40D 02	9.904D-02	7.948D-02	1.369D-02	5.117D-03	7.455D-04	0.0	0.0
4.50D 02	9.763D-02	7.825D-02	1.354D-02	5.104D-03	7.430D-04	0.0	0.0
4.60D 02	9.627D-02	7.705D-02	1.339D-02	5.089D-03	7.405D-04	0.0	0.0
4.70D 02	9.494D-02	7.590D-02	1.324D-02	5.073D-03	7.379D-04	0.0	0.0
4.80D 02	9.360D-02	7.478D-02	1.309D-02	5.055D-03	7.353D-04	0.0	0.0
4.90D 02	9.241D-02	7.369D-02	1.295D-02	5.037D-03	7.326D-04	0.0	0.0
5.00D 02	9.120D-02	7.264D-02	1.280D-02	5.019D-03	7.299D-04	0.0	0.0

ELECTRON ENERGY EV	INVERSE MFP A-1	INDIVIDUAL CONTRIBUTIONS TO THE INVERSE MFP IN UNITS OF A-1					
		VAL(9EV)	VAL(29EV)	AL(2P)	AL(2S)	O(1S)	AL(1S)
5.10D 02	9.002D-02	7.163D-02	1.267D-02	5.000D-03	7.273D-04	0.0	0.0
5.20D 02	8.887D-02	7.064D-02	1.253D-02	4.980D-03	7.246D-04	0.0	0.0
5.30D 02	8.776D-02	6.968D-02	1.240D-02	4.958D-03	7.219D-04	0.0	0.0
5.40D 02	8.667D-02	6.875D-02	1.227D-02	4.935D-03	7.193D-04	2.822D-08	0.0
5.50D 02	8.561D-02	6.785D-02	1.214D-02	4.911D-03	7.154D-04	4.375D-07	0.0
5.60D 02	8.458D-02	6.697D-02	1.201D-02	4.886D-03	7.107D-04	1.300D-06	0.0
5.70D 02	8.357D-02	6.611D-02	1.189D-02	4.862D-03	7.061D-04	2.551D-06	0.0
5.80D 02	8.260D-02	6.528D-02	1.177D-02	4.839D-03	7.015D-04	3.984D-06	0.0
5.90D 02	8.165D-02	6.448D-02	1.165D-02	4.815D-03	6.971D-04	5.543D-06	0.0
6.00D 02	8.072D-02	6.369D-02	1.154D-02	4.792D-03	6.927D-04	7.195D-06	0.0
6.10D 02	7.981D-02	6.292D-02	1.142D-02	4.770D-03	6.883D-04	8.874D-06	0.0
6.20D 02	7.893D-02	6.218D-02	1.131D-02	4.747D-03	6.841D-04	1.056D-05	0.0
6.30D 02	7.807D-02	6.145D-02	1.120D-02	4.724D-03	6.800D-04	1.224D-05	0.0
6.40D 02	7.723D-02	6.074D-02	1.110D-02	4.701D-03	6.759D-04	1.391D-05	0.0
6.50D 02	7.641D-02	6.005D-02	1.099D-02	4.678D-03	6.719D-04	1.553D-05	0.0
6.60D 02	7.560D-02	5.937D-02	1.089D-02	4.655D-03	6.680D-04	1.711D-05	0.0
6.70D 02	7.482D-02	5.872D-02	1.079D-02	4.631D-03	6.642D-04	1.866D-05	0.0
6.80D 02	7.405D-02	5.807D-02	1.069D-02	4.607D-03	6.605D-04	2.016D-05	0.0
6.90D 02	7.330D-02	5.745D-02	1.059D-02	4.580D-03	6.569D-04	2.177D-05	0.0
7.00D 02	7.256D-02	5.684D-02	1.050D-02	4.554D-03	6.533D-04	2.336D-05	0.0
7.10D 02	7.184D-02	5.624D-02	1.040D-02	4.528D-03	6.498D-04	2.494D-05	0.0
7.20D 02	7.114D-02	5.565D-02	1.031D-02	4.503D-03	6.464D-04	2.650D-05	0.0
7.30D 02	7.045D-02	5.508D-02	1.022D-02	4.479D-03	6.430D-04	2.802D-05	0.0
7.40D 02	6.978D-02	5.452D-02	1.013D-02	4.456D-03	6.397D-04	2.951D-05	0.0
7.50D 02	6.912D-02	5.397D-02	1.005D-02	4.434D-03	6.364D-04	3.096D-05	0.0
7.60D 02	6.848D-02	5.344D-02	9.962D-03	4.413D-03	6.332D-04	3.238D-05	0.0
7.70D 02	6.785D-02	5.291D-02	9.878D-03	4.390D-03	6.300D-04	3.376D-05	0.0
7.80D 02	6.723D-02	5.240D-02	9.796D-03	4.368D-03	6.269D-04	3.511D-05	0.0
7.90D 02	6.662D-02	5.190D-02	9.716D-03	4.347D-03	6.239D-04	3.643D-05	0.0
8.00D 02	6.603D-02	5.141D-02	9.637D-03	4.325D-03	6.208D-04	3.771D-05	0.0
8.10D 02	6.545D-02	5.093D-02	9.559D-03	4.307D-03	6.179D-04	3.895D-05	0.0
8.20D 02	6.488D-02	5.045D-02	9.482D-03	4.287D-03	6.145D-04	4.015D-05	0.0
8.30D 02	6.432D-02	4.999D-02	9.407D-03	4.264D-03	6.106D-04	4.129D-05	0.0
8.40D 02	6.376D-02	4.954D-02	9.332D-03	4.241D-03	6.067D-04	4.240D-05	0.0
8.50D 02	6.322D-02	4.909D-02	9.259D-03	4.218D-03	6.028D-04	4.348D-05	0.0
8.60D 02	6.269D-02	4.866D-02	9.187D-03	4.195D-03	5.990D-04	4.453D-05	0.0
8.70D 02	6.216D-02	4.823D-02	9.116D-03	4.173D-03	5.953D-04	4.556D-05	0.0
8.80D 02	6.165D-02	4.781D-02	9.046D-03	4.150D-03	5.917D-04	4.656D-05	0.0
8.90D 02	6.114D-02	4.740D-02	8.977D-03	4.128D-03	5.881D-04	4.753D-05	0.0
9.00D 02	6.065D-02	4.700D-02	8.908D-03	4.105D-03	5.846D-04	4.848D-05	0.0
9.10D 02	6.016D-02	4.660D-02	8.841D-03	4.083D-03	5.811D-04	4.942D-05	0.0
9.20D 02	5.968D-02	4.621D-02	8.776D-03	4.061D-03	5.777D-04	5.033D-05	0.0
9.30D 02	5.920D-02	4.583D-02	8.711D-03	4.039D-03	5.744D-04	5.122D-05	0.0
9.40D 02	5.874D-02	4.545D-02	8.647D-03	4.018D-03	5.711D-04	5.210D-05	0.0
9.50D 02	5.829D-02	4.509D-02	8.584D-03	3.996D-03	5.679D-04	5.296D-05	0.0
9.60D 02	5.784D-02	4.472D-02	8.522D-03	3.975D-03	5.647D-04	5.380D-05	0.0
9.70D 02	5.740D-02	4.437D-02	8.461D-03	3.954D-03	5.616D-04	5.462D-05	0.0
9.80D 02	5.697D-02	4.402D-02	8.401D-03	3.933D-03	5.585D-04	5.543D-05	0.0
9.90D 02	5.654D-02	4.367D-02	8.342D-03	3.912D-03	5.555D-04	5.622D-05	0.0
1.00D 03	5.612D-02	4.334D-02	8.284D-03	3.892D-03	5.526D-04	5.700D-05	0.0
1.05D 03	5.412D-02	4.173D-02	8.006D-03	3.792D-03	5.386D-04	6.063D-05	0.0
1.10D 03	5.226D-02	4.024D-02	7.750D-03	3.696D-03	5.252D-04	6.376D-05	0.0
1.15D 03	5.056D-02	3.887D-02	7.511D-03	3.606D-03	5.114D-04	6.621D-05	0.0

TABLE 2A-INVERSE MEAN FREE PATH OF ELECTRONS IN AL2O3 (DENSITY 4.05G/CM3)

ELECTRON ENERGY EV	INVERSE MFP A-1	INDIVIDUAL CONTRIBUTIONS TO THE INVERSE MFP IN UNITS OF A-1					
		VAL(9EV)	VAL(29EV)	AL(2P)	AL(2S)	O(1S)	AL(1S)
1.20D 03	4.097D-02	3.759D-02	7.289D-03	3.519D-03	4.987D-04	6.840D-05	0.0
1.25D 03	4.748D-02	3.641D-02	7.083D-03	3.437D-03	4.871D-04	7.036D-05	0.0
1.30D 03	4.609D-02	3.530D-02	6.891D-03	3.358D-03	4.751D-04	7.212D-05	0.0
1.35D 03	4.479D-02	3.426D-02	6.711D-03	3.283D-03	4.632D-04	7.370D-05	0.0
1.40D 03	4.356D-02	3.328D-02	6.542D-03	3.211D-03	4.515D-04	7.468D-05	0.0
1.45D 03	4.241D-02	3.237D-02	6.380D-03	3.143D-03	4.405D-04	7.541D-05	0.0
1.50D 03	4.131D-02	3.150D-02	6.226D-03	3.077D-03	4.311D-04	7.604D-05	0.0
1.55D 03	4.028D-02	3.069D-02	6.079D-03	3.014D-03	4.219D-04	7.658D-05	1.819D-10
1.60D 03	3.930D-02	2.992D-02	5.939D-03	2.953D-03	4.131D-04	7.704D-05	3.435D-08
1.65D 03	3.837D-02	2.919D-02	5.806D-03	2.894D-03	4.047D-04	7.745D-05	1.286D-07
1.70D 03	3.749D-02	2.850D-02	5.679D-03	2.838D-03	3.965D-04	7.780D-05	2.365D-07
1.75D 03	3.665D-02	2.784D-02	5.558D-03	2.784D-03	3.887D-04	7.812D-05	3.547D-07
1.80D 03	3.585D-02	2.721D-02	5.442D-03	2.732D-03	3.811D-04	7.841D-05	4.799D-07
1.85D 03	3.508D-02	2.662D-02	5.331D-03	2.682D-03	3.738D-04	7.868D-05	6.087D-07
1.90D 03	3.436D-02	2.605D-02	5.225D-03	2.634D-03	3.669D-04	7.893D-05	7.367D-07
1.95D 03	3.366D-02	2.551D-02	5.124D-03	2.588D-03	3.601D-04	7.916D-05	8.624D-07
2.00D 03	3.299D-02	2.499D-02	5.027D-03	2.543D-03	3.536D-04	7.936D-05	9.837D-07
2.05D 03	3.235D-02	2.449D-02	4.934D-03	2.500D-03	3.473D-04	7.947D-05	1.100D-06
2.10D 03	3.174D-02	2.402D-02	4.844D-03	2.459D-03	3.412D-04	7.919D-05	1.211D-06
2.15D 03	3.115D-02	2.356D-02	4.758D-03	2.419D-03	3.353D-04	7.891D-05	1.316D-06
2.20D 03	3.059D-02	2.312D-02	4.675D-03	2.381D-03	3.297D-04	7.864D-05	1.422D-06
2.25D 03	3.004D-02	2.270D-02	4.595D-03	2.344D-03	3.242D-04	7.837D-05	1.529D-06
2.30D 03	2.952D-02	2.230D-02	4.518D-03	2.308D-03	3.190D-04	7.806D-05	1.631D-06
2.35D 03	2.902D-02	2.191D-02	4.444D-03	2.273D-03	3.139D-04	7.776D-05	1.729D-06
2.40D 03	2.853D-02	2.153D-02	4.373D-03	2.240D-03	3.090D-04	7.745D-05	1.824D-06
2.45D 03	2.807D-02	2.117D-02	4.304D-03	2.208D-03	3.043D-04	7.715D-05	1.914D-06
2.50D 03	2.761D-02	2.082D-02	4.237D-03	2.177D-03	2.997D-04	7.683D-05	2.001D-06
2.55D 03	2.718D-02	2.049D-02	4.172D-03	2.147D-03	2.953D-04	7.653D-05	2.084D-06
2.60D 03	2.675D-02	2.016D-02	4.110D-03	2.118D-03	2.910D-04	7.620D-05	2.164D-06
2.65D 03	2.633D-02	1.985D-02	4.049D-03	2.090D-03	2.869D-04	7.588D-05	2.240D-06
2.70D 03	2.596D-02	1.954D-02	3.991D-03	2.063D-03	2.829D-04	7.554D-05	2.314D-06
2.75D 03	2.558D-02	1.925D-02	3.934D-03	2.036D-03	2.790D-04	7.519D-05	2.382D-06
2.80D 03	2.521D-02	1.897D-02	3.879D-03	2.011D-03	2.753D-04	7.497D-05	2.445D-06
2.85D 03	2.485D-02	1.869D-02	3.826D-03	1.986D-03	2.717D-04	7.448D-05	2.506D-06
2.90D 03	2.450D-02	1.842D-02	3.774D-03	1.961D-03	2.681D-04	7.413D-05	2.564D-06
2.95D 03	2.417D-02	1.817D-02	3.724D-03	1.937D-03	2.647D-04	7.378D-05	2.620D-06
3.00D 03	2.384D-02	1.791D-02	3.675D-03	1.914D-03	2.614D-04	7.341D-05	2.673D-06
3.10D 03	2.321D-02	1.743D-02	3.581D-03	1.869D-03	2.551D-04	7.267D-05	2.773D-06
3.20D 03	2.262D-02	1.698D-02	3.493D-03	1.826D-03	2.491D-04	7.192D-05	2.866D-06
3.30D 03	2.206D-02	1.655D-02	3.409D-03	1.786D-03	2.435D-04	7.116D-05	2.948D-06
3.40D 03	2.153D-02	1.614D-02	3.329D-03	1.747D-03	2.382D-04	7.038D-05	3.021D-06
3.50D 03	2.103D-02	1.576D-02	3.253D-03	1.710D-03	2.331D-04	6.958D-05	3.087D-06
3.60D 03	2.055D-02	1.539D-02	3.181D-03	1.574D-03	2.284D-04	6.879D-05	3.147D-06
3.70D 03	2.009D-02	1.505D-02	3.112D-03	1.641D-03	2.238D-04	6.799D-05	3.202D-06
3.80D 03	1.966D-02	1.471D-02	3.047D-03	1.608D-03	2.196D-04	6.719D-05	3.252D-06
3.90D 03	1.924D-02	1.440D-02	2.984D-03	1.577D-03	2.155D-04	6.641D-05	3.298D-06
4.00D 03	1.883D-02	1.410D-02	2.924D-03	1.548D-03	2.117D-04	6.563D-05	3.340D-06
4.10D 03	1.847D-02	1.380D-02	2.867D-03	1.519D-03	2.080D-04	6.488D-05	3.377D-06
4.20D 03	1.810D-02	1.353D-02	2.812D-03	1.492D-03	2.045D-04	6.413D-05	3.406D-06
4.30D 03	1.775D-02	1.326D-02	2.759D-03	1.465D-03	2.010D-04	6.340D-05	3.432D-06
4.40D 03	1.742D-02	1.301D-02	2.708D-03	1.440D-03	1.975D-04	6.268D-05	3.455D-06
4.50D 03	1.710D-02	1.277D-02	2.660D-03	1.416D-03	1.942D-04	6.198D-05	3.476D-06
4.60D 03	1.679D-02	1.253D-02	2.613D-03	1.392D-03	1.910D-04	6.130D-05	3.489D-06

ELECTRON ENERGY EV	INVERSE MFP A-1	INDIVIDUAL CONTRIBUTIONS TO THE INVERSE MFP IN UNITS OF A-1					
		VAL(9EV)	VAL(29EV)	AL(2P)	AL(2S)	O(1S)	AL(1S)
4.70D 03	1.650D-02	1.231D-02	2.568D-03	1.369D-03	1.879D-04	6.063D-05	3.500D-06
4.80D 03	1.621D-02	1.209D-02	2.524D-03	1.348D-03	1.849D-04	5.998D-05	3.508D-06
4.90D 03	1.594D-02	1.188D-02	2.483D-03	1.326D-03	1.820D-04	5.935D-05	3.513D-06
5.00D 03	1.567D-02	1.168D-02	2.442D-03	1.306D-03	1.791D-04	5.873D-05	3.516D-06
5.10D 03	1.541D-02	1.149D-02	2.403D-03	1.286D-03	1.764D-04	5.812D-05	3.518D-06
5.20D 03	1.517D-02	1.130D-02	2.366D-03	1.267D-03	1.738D-04	5.754D-05	3.519D-06
5.30D 03	1.493D-02	1.112D-02	2.329D-03	1.249D-03	1.712D-04	5.696D-05	3.517D-06
5.40D 03	1.470D-02	1.094D-02	2.294D-03	1.231D-03	1.687D-04	5.640D-05	3.515D-06
5.50D 03	1.447D-02	1.078D-02	2.260D-03	1.213D-03	1.663D-04	5.586D-05	3.509D-06
5.60D 03	1.426D-02	1.061D-02	2.227D-03	1.196D-03	1.639D-04	5.532D-05	3.502D-06
5.70D 03	1.405D-02	1.045D-02	2.195D-03	1.180D-03	1.617D-04	5.480D-05	3.494D-06
5.80D 03	1.385D-02	1.030D-02	2.164D-03	1.164D-03	1.594D-04	5.430D-05	3.485D-06
5.90D 03	1.365D-02	1.015D-02	2.134D-03	1.149D-03	1.573D-04	5.380D-05	3.477D-06
6.00D 03	1.346D-02	1.001D-02	2.104D-03	1.134D-03	1.552D-04	5.332D-05	3.467D-06
6.10D 03	1.327D-02	9.867D-03	2.076D-03	1.119D-03	1.532D-04	5.285D-05	3.457D-06
6.20D 03	1.309D-02	9.733D-03	2.049D-03	1.105D-03	1.512D-04	5.239D-05	3.445D-06
6.30D 03	1.292D-02	9.601D-03	2.022D-03	1.091D-03	1.493D-04	5.194D-05	3.434D-06
6.40D 03	1.275D-02	9.473D-03	1.996D-03	1.078D-03	1.475D-04	5.151D-05	3.420D-06
6.50D 03	1.258D-02	9.348D-03	1.971D-03	1.065D-03	1.456D-04	5.109D-05	3.408D-06
6.60D 03	1.242D-02	9.228D-03	1.946D-03	1.052D-03	1.439D-04	5.066D-05	3.395D-06
6.70D 03	1.227D-02	9.110D-03	1.922D-03	1.040D-03	1.422D-04	5.026D-05	3.381D-06
6.80D 03	1.212D-02	8.996D-03	1.899D-03	1.028D-03	1.405D-04	4.986D-05	3.368D-06
6.90D 03	1.197D-02	8.884D-03	1.876D-03	1.016D-03	1.388D-04	4.947D-05	3.353D-06
7.00D 03	1.182D-02	8.776D-03	1.854D-03	1.005D-03	1.372D-04	4.909D-05	3.339D-06
7.10D 03	1.168D-02	8.671D-03	1.832D-03	9.933D-04	1.357D-04	4.872D-05	3.325D-06
7.20D 03	1.155D-02	8.567D-03	1.811D-03	9.823D-04	1.342D-04	4.836D-05	3.310D-06
7.30D 03	1.141D-02	8.466D-03	1.791D-03	9.716D-04	1.327D-04	4.801D-05	3.295D-06
7.40D 03	1.128D-02	8.369D-03	1.771D-03	9.612D-04	1.312D-04	4.766D-05	3.280D-06
7.50D 03	1.116D-02	8.273D-03	1.751D-03	9.510D-04	1.298D-04	4.733D-05	3.265D-06
7.60D 03	1.103D-02	8.180D-03	1.732D-03	9.411D-04	1.284D-04	4.700D-05	3.250D-06
7.70D 03	1.091D-02	8.090D-03	1.713D-03	9.314D-04	1.271D-04	4.668D-05	3.235D-06
7.80D 03	1.079D-02	8.001D-03	1.695D-03	9.219D-04	1.257D-04	4.638D-05	3.220D-06
7.90D 03	1.068D-02	7.913D-03	1.677D-03	9.125D-04	1.244D-04	4.607D-05	3.205D-06
8.00D 03	1.056D-02	7.828D-03	1.660D-03	9.034D-04	1.232D-04	4.578D-05	3.190D-06
8.10D 03	1.045D-02	7.745D-03	1.643D-03	8.945D-04	1.219D-04	4.550D-05	3.174D-06
8.20D 03	1.035D-02	7.664D-03	1.626D-03	8.858D-04	1.207D-04	4.523D-05	3.159D-06
8.30D 03	1.024D-02	7.585D-03	1.610D-03	8.773D-04	1.195D-04	4.495D-05	3.144D-06
8.40D 03	1.014D-02	7.508D-03	1.594D-03	8.689D-04	1.184D-04	4.467D-05	3.129D-06
8.50D 03	1.004D-02	7.432D-03	1.578D-03	8.607D-04	1.172D-04	4.439D-05	3.114D-06
8.60D 03	9.936D-03	7.358D-03	1.563D-03	8.527D-04	1.161D-04	4.411D-05	3.099D-06
8.70D 03	9.839D-03	7.285D-03	1.548D-03	8.449D-04	1.150D-04	4.383D-05	3.084D-06
8.80D 03	9.744D-03	7.214D-03	1.533D-03	8.371D-04	1.139D-04	4.355D-05	3.068D-06
8.90D 03	9.651D-03	7.144D-03	1.519D-03	8.296D-04	1.129D-04	4.328D-05	3.053D-06
9.00D 03	9.560D-03	7.076D-03	1.505D-03	8.222D-04	1.119D-04	4.300D-05	3.038D-06
9.10D 03	9.471D-03	7.009D-03	1.491D-03	8.149D-04	1.109D-04	4.272D-05	3.023D-06
9.20D 03	9.383D-03	6.943D-03	1.477D-03	8.078D-04	1.099D-04	4.245D-05	3.008D-06
9.30D 03	9.298D-03	6.879D-03	1.464D-03	8.008D-04	1.089D-04	4.218D-05	2.993D-06
9.40D 03	9.213D-03	6.816D-03	1.451D-03	7.939D-04	1.079D-04	4.191D-05	2.977D-06
9.50D 03	9.131D-03	6.754D-03	1.438D-03	7.872D-04	1.070D-04	4.165D-05	2.963D-06
9.60D 03	9.050D-03	6.693D-03	1.426D-03	7.806D-04	1.061D-04	4.139D-05	2.948D-06
9.70D 03	8.970D-03	6.634D-03	1.413D-03	7.741D-04	1.052D-04	4.113D-05	2.933D-06
9.80D 03	8.893D-03	6.576D-03	1.401D-03	7.677D-04	1.043D-04	4.087D-05	2.918D-06
9.90D 03	8.816D-03	6.519D-03	1.389D-03	7.614D-04	1.034D-04	4.062D-05	2.904D-06
1.00D 04	8.741D-03	6.463D-03	1.378D-03	7.553D-04	1.026D-04	4.037D-05	2.889D-06

TABLE 28-STOPPING POWER OF ALUMINUM OXIDE (DENSITY 4.05G/CM3) FOR ELECTRONS

ELECTRON ENERGY EV	STOPPING POWER EV/A	INDIVIDUAL CONTRIBUTIONS TO THE STOPPING POWER IN UNITS OF EV/A					
		VAL(9EV)	VAL(29EV)	AL(2P)	AL(2S)	O(1S)	AL(1S)
5.00D-01	0.0	0.0	0.0	0.0	0.0	0.0	0.0
1.00D 00	0.0	0.0	0.0	0.0	0.0	0.0	0.0
2.00D 00	0.0	0.0	0.0	0.0	0.0	0.0	0.0
3.00D 00	0.0	0.0	0.0	0.0	0.0	0.0	0.0
4.00D 00	0.0	0.0	0.0	0.0	0.0	0.0	0.0
5.00D 00	0.0	0.0	0.0	0.0	0.0	0.0	0.0
6.00D 00	0.0	0.0	0.0	0.0	0.0	0.0	0.0
7.00D 00	0.0	0.0	0.0	0.0	0.0	0.0	0.0
8.00D 00	0.0	0.0	0.0	0.0	0.0	0.0	0.0
9.00D 00	0.0	0.0	0.0	0.0	0.0	0.0	0.0
1.00D 01	2.183D-02	2.183D-02	0.0	0.0	0.0	0.0	0.0
1.10D 01	5.827D-02	5.827D-02	0.0	0.0	0.0	0.0	0.0
1.20D 01	9.820D-02	9.820D-02	0.0	0.0	0.0	0.0	0.0
1.30D 01	1.401D-01	1.401D-01	0.0	0.0	0.0	0.0	0.0
1.40D 01	1.834D-01	1.834D-01	0.0	0.0	0.0	0.0	0.0
1.50D 01	2.281D-01	2.281D-01	0.0	0.0	0.0	0.0	0.0
1.60D 01	2.745D-01	2.745D-01	0.0	0.0	0.0	0.0	0.0
1.70D 01	3.226D-01	3.226D-01	0.0	0.0	0.0	0.0	0.0
1.80D 01	3.725D-01	3.725D-01	0.0	0.0	0.0	0.0	0.0
1.90D 01	4.242D-01	4.242D-01	0.0	0.0	0.0	0.0	0.0
2.00D 01	4.778D-01	4.778D-01	0.0	0.0	0.0	0.0	0.0
2.10D 01	5.343D-01	5.343D-01	0.0	0.0	0.0	0.0	0.0
2.20D 01	5.922D-01	5.922D-01	0.0	0.0	0.0	0.0	0.0
2.30D 01	6.513D-01	6.513D-01	0.0	0.0	0.0	0.0	0.0
2.40D 01	7.111D-01	7.111D-01	0.0	0.0	0.0	0.0	0.0
2.50D 01	7.713D-01	7.713D-01	0.0	0.0	0.0	0.0	0.0
2.60D 01	8.313D-01	8.313D-01	0.0	0.0	0.0	0.0	0.0
2.70D 01	8.907D-01	8.907D-01	0.0	0.0	0.0	0.0	0.0
2.80D 01	9.491D-01	9.491D-01	0.0	0.0	0.0	0.0	0.0
2.90D 01	1.006D 00	1.006D 00	6.474D-05	0.0	0.0	0.0	0.0
3.00D 01	1.062D 00	1.061D 00	5.816D-04	0.0	0.0	0.0	0.0
3.20D 01	1.226D 00	1.223D 00	3.251D-03	0.0	0.0	0.0	0.0
3.40D 01	1.389D 00	1.381D 00	8.482D-03	0.0	0.0	0.0	0.0
3.60D 01	1.548D 00	1.531D 00	1.645D-02	0.0	0.0	0.0	0.0
3.80D 01	1.699D 00	1.672D 00	2.720D-02	0.0	0.0	0.0	0.0
4.00D 01	1.841D 00	1.800D 00	4.070D-02	0.0	0.0	0.0	0.0
4.20D 01	2.039D 00	1.982D 00	5.684D-02	0.0	0.0	0.0	0.0
4.40D 01	2.228D 00	2.152D 00	7.549D-02	0.0	0.0	0.0	0.0
4.60D 01	2.405D 00	2.308D 00	9.651D-02	0.0	0.0	0.0	0.0
4.80D 01	2.570D 00	2.450D 00	1.198D-01	0.0	0.0	0.0	0.0
5.00D 01	2.723D 00	2.578D 00	1.451D-01	0.0	0.0	0.0	0.0
5.20D 01	2.924D 00	2.752D 00	1.724D-01	0.0	0.0	0.0	0.0
5.40D 01	3.113D 00	2.912D 00	2.014D-01	0.0	0.0	0.0	0.0
5.60D 01	3.289D 00	3.059D 00	2.305D-01	0.0	0.0	0.0	0.0
5.80D 01	3.453D 00	3.193D 00	2.593D-01	0.0	0.0	0.0	0.0
6.00D 01	3.603D 00	3.315D 00	2.877D-01	0.0	0.0	0.0	0.0
6.20D 01	3.770D 00	3.455D 00	3.156D-01	0.0	0.0	0.0	0.0
6.40D 01	3.927D 00	3.585D 00	3.429D-01	0.0	0.0	0.0	0.0
6.60D 01	4.074D 00	3.704D 00	3.692D-01	0.0	0.0	0.0	0.0
6.80D 01	4.209D 00	3.815D 00	3.947D-01	0.0	0.0	0.0	0.0
7.00D 01	4.335D 00	3.915D 00	4.193D-01	0.0	0.0	0.0	0.0
7.20D 01	4.459D 00	4.017D 00	4.427D-01	0.0	0.0	0.0	0.0
7.40D 01	4.576D 00	4.111D 00	4.652D-01	0.0	0.0	0.0	0.0

ELECTRON ENERGY EV	STOPPING POWER EV/A	INDIVIDUAL CONTRIBUTIONS TO THE STOPPING POWER IN UNITS OF EV/A					
		VAL(9EV)	VAL(29EV)	AL(2P)	AL(2S)	O(1S)	AL(1S)
7.60D 01	4.697D 00	4.210D 00	4.866D-01	0.0	0.0	0.0	0.0
7.80D 01	4.807D 00	4.300D 00	5.070D-01	0.0	0.0	0.0	0.0
8.00D 01	4.906D 00	4.380D 00	5.263D-01	0.0	0.0	0.0	0.0
8.20D 01	5.002D 00	4.457D 00	5.447D-01	2.799D-04	0.0	0.0	0.0
8.40D 01	5.089D 00	4.525D 00	5.621D-01	2.128D-03	0.0	0.0	0.0
8.60D 01	5.171D 00	4.587D 00	5.785D-01	5.420D-03	0.0	0.0	0.0
8.80D 01	5.252D 00	4.648D 00	5.941D-01	1.008D-02	0.0	0.0	0.0
9.00D 01	5.333D 00	4.708D 00	6.088D-01	1.602D-02	0.0	0.0	0.0
9.20D 01	5.406D 00	4.760D 00	6.227D-01	2.305D-02	0.0	0.0	0.0
9.40D 01	5.477D 00	4.810D 00	6.359D-01	3.082D-02	0.0	0.0	0.0
9.60D 01	5.545D 00	4.858D 00	6.483D-01	3.892D-02	0.0	0.0	0.0
9.80D 01	5.607D 00	4.900D 00	6.600D-01	4.737D-02	0.0	0.0	0.0
1.00D 02	5.668D 00	4.941D 00	6.711D-01	5.622D-02	0.0	0.0	0.0
1.10D 02	5.923D 00	5.098D 00	7.222D-01	1.029D-01	0.0	0.0	0.0
1.20D 02	6.132D 00	5.194D 00	7.883D-01	1.497D-01	3.871D-05	0.0	0.0
1.30D 02	6.262D 00	5.221D 00	8.425D-01	1.949D-01	3.559D-03	0.0	0.0
1.40D 02	6.326D 00	5.187D 00	8.883D-01	2.395D-01	1.089D-02	0.0	0.0
1.50D 02	6.332D 00	5.101D 00	9.279D-01	2.855D-01	1.778D-02	0.0	0.0
1.60D 02	6.321D 00	5.009D 00	9.596D-01	3.274D-01	2.499D-02	0.0	0.0
1.70D 02	6.296D 00	4.913D 00	9.862D-01	3.646D-01	3.243D-02	0.0	0.0
1.80D 02	6.262D 00	4.816D 00	1.009D 00	3.972D-01	4.001D-02	0.0	0.0
1.90D 02	6.220D 00	4.718D 00	1.029D 00	4.253D-01	4.767D-02	0.0	0.0
2.00D 02	6.170D 00	4.622D 00	1.043D 00	4.493D-01	5.531D-02	0.0	0.0
2.10D 02	6.120D 00	4.528D 00	1.055D 00	4.741D-01	6.286D-02	0.0	0.0
2.20D 02	6.070D 00	4.436D 00	1.065D 00	4.994D-01	7.027D-02	0.0	0.0
2.30D 02	6.017D 00	4.346D 00	1.071D 00	5.223D-01	7.747D-02	0.0	0.0
2.40D 02	5.962D 00	4.259D 00	1.076D 00	5.430D-01	8.442D-02	0.0	0.0
2.50D 02	5.907D 00	4.174D 00	1.080D 00	5.616D-01	9.114D-02	0.0	0.0
2.60D 02	5.852D 00	4.093D 00	1.083D 00	5.782D-01	9.762D-02	0.0	0.0
2.70D 02	5.796D 00	4.014D 00	1.085D 00	5.927D-01	1.039D-01	0.0	0.0
2.80D 02	5.737D 00	3.939D 00	1.084D 00	6.067D-01	1.078D-01	0.0	0.0
2.90D 02	5.680D 00	3.867D 00	1.082D 00	6.201D-01	1.110D-01	0.0	0.0
3.00D 02	5.624D 00	3.798D 00	1.079D 00	6.325D-01	1.140D-01	0.0	0.0
3.10D 02	5.568D 00	3.731D 00	1.077D 00	6.438D-01	1.167D-01	0.0	0.0
3.20D 02	5.514D 00	3.666D 00	1.074D 00	6.540D-01	1.192D-01	0.0	0.0
3.30D 02	5.458D 00	3.604D 00	1.070D 00	6.630D-01	1.216D-01	0.0	0.0
3.40D 02	5.404D 00	3.543D 00	1.066D 00	6.709D-01	1.238D-01	0.0	0.0
3.50D 02	5.351D 00	3.484D 00	1.063D 00	6.786D-01	1.259D-01	0.0	0.0
3.60D 02	5.299D 00	3.427D 00	1.059D 00	6.856D-01	1.278D-01	0.0	0.0
3.70D 02	5.248D 00	3.372D 00	1.054D 00	6.922D-01	1.297D-01	0.0	0.0
3.80D 02	5.199D 00	3.319D 00	1.050D 00	6.982D-01	1.314D-01	0.0	0.0
3.90D 02	5.150D 00	3.268D 00	1.046D 00	7.038D-01	1.331D-01	0.0	0.0
4.00D 02	5.103D 00	3.218D 00	1.041D 00	7.088D-01	1.346D-01	0.0	0.0
4.10D 02	5.056D 00	3.170D 00	1.037D 00	7.134D-01	1.360D-01	0.0	0.0
4.20D 02	5.009D 00	3.123D 00	1.032D 00	7.173D-01	1.367D-01	0.0	0.0
4.30D 02	4.963D 00	3.078D 00	1.028D 00	7.209D-01	1.373D-01	0.0	0.0
4.40D 02	4.918D 00	3.034D 00	1.023D 00	7.241D-01	1.379D-01	0.0	0.0
4.50D 02	4.874D 00	2.991D 00	1.018D 00	7.271D-01	1.385D-01	0.0	0.0
4.60D 02	4.829D 00	2.950D 00	1.011D 00	7.297D-01	1.390D-01	0.0	0.0
4.70D 02	4.785D 00	2.910D 00	1.004D 00	7.321D-01	1.395D-01	0.0	0.0
4.80D 02	4.741D 00	2.871D 00	9.963D-01	7.340D-01	1.399D-01	0.0	0.0
4.90D 02	4.698D 00	2.833D 00	9.892D-01	7.355D-01	1.403D-01	0.0	0.0
5.00D 02	4.656D 00	2.796D 00	9.819D-01	7.369D-01	1.407D-01	0.0	0.0

TABLE 2B-STOPPING POWER OF ALUMINUM OXIDE (DENSITY 4.05G/CM3) FOR ELECTRONS

ELECTRON ENERGY EV	STOPPING POWER EV/A	INDIVIDUAL CONTRIBUTIONS TO THE STOPPING POWER IN UNITS OF EV/A					
		VAL(9EV)	VAL(29EV)	AL(2P)	AL(2S)	O(1S)	AL(1S)
5.10D 02	4.614D 00	2.761D 00	9.747D-01	7.380D-01	1.410D-01	0.0	0.0
5.20D 02	4.574D 00	2.726D 00	9.675D-01	7.391D-01	1.414D-01	0.0	0.0
5.30D 02	4.534D 00	2.692D 00	9.604D-01	7.399D-01	1.417D-01	0.0	0.0
5.40D 02	4.495D 00	2.659D 00	9.532D-01	7.406D-01	1.420D-01	1.517D-05	0.0
5.50D 02	4.456D 00	2.627D 00	9.461D-01	7.407D-01	1.420D-01	2.362D-04	0.0
5.60D 02	4.418D 00	2.596D 00	9.391D-01	7.406D-01	1.418D-01	7.053D-04	0.0
5.70D 02	4.381D 00	2.565D 00	9.321D-01	7.404D-01	1.417D-01	1.390D-03	0.0
5.80D 02	4.345D 00	2.536D 00	9.252D-01	7.402D-01	1.415D-01	2.182D-03	0.0
5.90D 02	4.310D 00	2.507D 00	9.184D-01	7.400D-01	1.413D-01	3.051D-03	0.0
6.00D 02	4.275D 00	2.479D 00	9.116D-01	7.397D-01	1.411D-01	3.979D-03	0.0
6.10D 02	4.241D 00	2.451D 00	9.049D-01	7.393D-01	1.409D-01	4.931D-03	0.0
6.20D 02	4.208D 00	2.424D 00	8.982D-01	7.390D-01	1.407D-01	5.894D-03	0.0
6.30D 02	4.176D 00	2.398D 00	8.917D-01	7.385D-01	1.405D-01	6.865D-03	0.0
6.40D 02	4.144D 00	2.373D 00	8.852D-01	7.380D-01	1.403D-01	7.833D-03	0.0
6.50D 02	4.113D 00	2.348D 00	8.788D-01	7.374D-01	1.401D-01	8.787D-03	0.0
6.60D 02	4.082D 00	2.324D 00	8.725D-01	7.367D-01	1.399D-01	9.726D-03	0.0
6.70D 02	4.052D 00	2.300D 00	8.663D-01	7.360D-01	1.397D-01	1.065D-02	0.0
6.80D 02	4.023D 00	2.276D 00	8.601D-01	7.352D-01	1.395D-01	1.155D-02	0.0
6.90D 02	3.993D 00	2.254D 00	8.540D-01	7.335D-01	1.393D-01	1.253D-02	0.0
7.00D 02	3.964D 00	2.232D 00	8.480D-01	7.318D-01	1.392D-01	1.350D-02	0.0
7.10D 02	3.935D 00	2.210D 00	8.421D-01	7.302D-01	1.390D-01	1.447D-02	0.0
7.20D 02	3.907D 00	2.188D 00	8.362D-01	7.286D-01	1.388D-01	1.544D-02	0.0
7.30D 02	3.880D 00	2.167D 00	8.305D-01	7.271D-01	1.386D-01	1.639D-02	0.0
7.40D 02	3.853D 00	2.147D 00	8.248D-01	7.256D-01	1.384D-01	1.733D-02	0.0
7.50D 02	3.827D 00	2.127D 00	8.192D-01	7.242D-01	1.382D-01	1.825D-02	0.0
7.60D 02	3.801D 00	2.108D 00	8.136D-01	7.229D-01	1.380D-01	1.916D-02	0.0
7.70D 02	3.776D 00	2.088D 00	8.081D-01	7.213D-01	1.378D-01	2.005D-02	0.0
7.80D 02	3.751D 00	2.070D 00	8.028D-01	7.198D-01	1.376D-01	2.093D-02	0.0
7.90D 02	3.726D 00	2.051D 00	7.974D-01	7.182D-01	1.374D-01	2.180D-02	0.0
8.00D 02	3.702D 00	2.033D 00	7.922D-01	7.166D-01	1.372D-01	2.265D-02	0.0
8.10D 02	3.678D 00	2.016D 00	7.870D-01	7.153D-01	1.370D-01	2.348D-02	0.0
8.20D 02	3.655D 00	1.998D 00	7.819D-01	7.143D-01	1.367D-01	2.429D-02	0.0
8.30D 02	3.632D 00	1.981D 00	7.768D-01	7.125D-01	1.363D-01	2.507D-02	0.0
8.40D 02	3.609D 00	1.964D 00	7.718D-01	7.107D-01	1.359D-01	2.584D-02	0.0
8.50D 02	3.586D 00	1.948D 00	7.669D-01	7.088D-01	1.354D-01	2.659D-02	0.0
8.60D 02	3.563D 00	1.932D 00	7.620D-01	7.069D-01	1.350D-01	2.733D-02	0.0
8.70D 02	3.541D 00	1.916D 00	7.572D-01	7.049D-01	1.346D-01	2.805D-02	0.0
8.80D 02	3.519D 00	1.901D 00	7.524D-01	7.029D-01	1.341D-01	2.877D-02	0.0
8.90D 02	3.497D 00	1.885D 00	7.477D-01	7.009D-01	1.337D-01	2.947D-02	0.0
9.00D 02	3.476D 00	1.870D 00	7.430D-01	6.988D-01	1.333D-01	3.016D-02	0.0
9.10D 02	3.454D 00	1.856D 00	7.384D-01	6.966D-01	1.329D-01	3.084D-02	0.0
9.20D 02	3.434D 00	1.841D 00	7.338D-01	6.945D-01	1.325D-01	3.151D-02	0.0
9.30D 02	3.413D 00	1.827D 00	7.293D-01	6.923D-01	1.321D-01	3.218D-02	0.0
9.40D 02	3.393D 00	1.813D 00	7.249D-01	6.902D-01	1.317D-01	3.283D-02	0.0
9.50D 02	3.373D 00	1.799D 00	7.205D-01	6.879D-01	1.313D-01	3.348D-02	0.0
9.60D 02	3.353D 00	1.786D 00	7.161D-01	6.857D-01	1.309D-01	3.411D-02	0.0
9.70D 02	3.333D 00	1.773D 00	7.118D-01	6.835D-01	1.305D-01	3.474D-02	0.0
9.80D 02	3.314D 00	1.760D 00	7.076D-01	6.813D-01	1.301D-01	3.536D-02	0.0
9.90D 02	3.295D 00	1.747D 00	7.034D-01	6.790D-01	1.298D-01	3.598D-02	0.0
1.00D 03	3.276D 00	1.734D 00	6.992D-01	6.768D-01	1.294D-01	3.658D-02	0.0
1.05D 03	3.186D 00	1.674D 00	6.793D-01	6.655D-01	1.276D-01	3.948D-02	0.0
1.10D 03	3.101D 00	1.618D 00	6.606D-01	6.543D-01	1.258D-01	4.210D-02	0.0
1.15D 03	3.021D 00	1.567D 00	6.431D-01	6.432D-01	1.240D-01	4.430D-02	0.0

TABLE 2B-STOPPING POWER OF ALUMINUM OXIDE (DENSITY 4.05G/CM3) FOR ELECTRONS

ELECTRON ENERGY EV	STOPPING POWER EV/A	INDIVIDUAL CONTRIBUTIONS TO THE STOPPING POWER IN UNITS OF EV/A					
		VAL(9EV)	VAL(29EV)	AL(2P)	AL(2S)	O(1S)	AL(1S)
1.20D 03	2.946D 00	1.518D 00	6.267D-01	6.323D-01	1.221D-01	4.635D-02	0.0
1.25D 03	2.875D 00	1.473D 00	6.113D-01	6.216D-01	1.203D-01	4.826D-02	0.0
1.30D 03	2.808D 00	1.431D 00	5.970D-01	6.112D-01	1.184D-01	5.005D-02	0.0
1.35D 03	2.744D 00	1.392D 00	5.835D-01	6.010D-01	1.166D-01	5.173D-02	0.0
1.40D 03	2.684D 00	1.354D 00	5.709D-01	5.911D-01	1.147D-01	5.299D-02	0.0
1.45D 03	2.627D 00	1.319D 00	5.589D-01	5.815D-01	1.128D-01	5.409D-02	0.0
1.50D 03	2.572D 00	1.286D 00	5.474D-01	5.721D-01	1.113D-01	5.510D-02	0.0
1.55D 03	2.520D 00	1.255D 00	5.364D-01	5.629D-01	1.097D-01	5.604D-02	2.814D-07
1.60D 03	2.470D 00	1.225D 00	5.259D-01	5.540D-01	1.082D-01	5.691D-02	5.356D-05
1.65D 03	2.423D 00	1.197D 00	5.158D-01	5.452D-01	1.067D-01	5.773D-02	2.021D-04
1.70D 03	2.377D 00	1.170D 00	5.062D-01	5.367D-01	1.052D-01	5.850D-02	3.750D-04
1.75D 03	2.334D 00	1.145D 00	4.969D-01	5.285D-01	1.038D-01	5.924D-02	5.669D-04
1.80D 03	2.292D 00	1.120D 00	4.879D-01	5.204D-01	1.023D-01	5.993D-02	7.729D-04
1.85D 03	2.252D 00	1.097D 00	4.793D-01	5.126D-01	1.010D-01	6.060D-02	9.877D-04
1.90D 03	2.213D 00	1.075D 00	4.711D-01	5.050D-01	9.959D-02	6.124D-02	1.204D-03
1.95D 03	2.176D 00	1.054D 00	4.631D-01	4.976D-01	9.826D-02	6.186D-02	1.420D-03
2.00D 03	2.141D 00	1.034D 00	4.554D-01	4.904D-01	9.696D-02	6.244D-02	1.632D-03
2.05D 03	2.106D 00	1.014D 00	4.479D-01	4.834D-01	9.568D-02	6.294D-02	1.838D-03
2.10D 03	2.073D 00	9.957D-01	4.408D-01	4.766D-01	9.444D-02	6.313D-02	2.038D-03
2.15D 03	2.040D 00	9.777D-01	4.338D-01	4.700D-01	9.322D-02	6.331D-02	2.230D-03
2.20D 03	2.009D 00	9.605D-01	4.271D-01	4.636D-01	9.203D-02	6.347D-02	2.425D-03
2.25D 03	1.979D 00	9.440D-01	4.207D-01	4.574D-01	9.087D-02	6.363D-02	2.625D-03
2.30D 03	1.950D 00	9.280D-01	4.144D-01	4.514D-01	8.975D-02	6.377D-02	2.820D-03
2.35D 03	1.922D 00	9.127D-01	4.083D-01	4.455D-01	8.865D-02	6.391D-02	3.009D-03
2.40D 03	1.895D 00	8.979D-01	4.024D-01	4.399D-01	8.758D-02	6.405D-02	3.194D-03
2.45D 03	1.869D 00	8.836D-01	3.967D-01	4.344D-01	8.654D-02	6.419D-02	3.373D-03
2.50D 03	1.843D 00	8.698D-01	3.912D-01	4.291D-01	8.553D-02	6.432D-02	3.548D-03
2.55D 03	1.819D 00	8.564D-01	3.858D-01	4.239D-01	8.455D-02	6.445D-02	3.718D-03
2.60D 03	1.795D 00	8.436D-01	3.805D-01	4.189D-01	8.360D-02	6.454D-02	3.883D-03
2.65D 03	1.772D 00	8.312D-01	3.755D-01	4.141D-01	8.267D-02	6.461D-02	4.044D-03
2.70D 03	1.750D 00	8.191D-01	3.705D-01	4.094D-01	8.178D-02	6.464D-02	4.201D-03
2.75D 03	1.728D 00	8.073D-01	3.657D-01	4.049D-01	8.090D-02	6.465D-02	4.348D-03
2.80D 03	1.707D 00	7.960D-01	3.610D-01	4.005D-01	8.005D-02	6.462D-02	4.489D-03
2.85D 03	1.686D 00	7.851D-01	3.565D-01	3.962D-01	7.924D-02	6.458D-02	4.626D-03
2.90D 03	1.666D 00	7.744D-01	3.521D-01	3.920D-01	7.844D-02	6.452D-02	4.758D-03
2.95D 03	1.647D 00	7.641D-01	3.478D-01	3.879D-01	7.767D-02	6.445D-02	4.888D-03
3.00D 03	1.628D 00	7.540D-01	3.436D-01	3.839D-01	7.692D-02	6.437D-02	5.013D-03
3.10D 03	1.591D 00	7.347D-01	3.356D-01	3.761D-01	7.548D-02	6.417D-02	5.254D-03
3.20D 03	1.557D 00	7.165D-01	3.279D-01	3.687D-01	7.413D-02	6.394D-02	5.483D-03
3.30D 03	1.524D 00	6.993D-01	3.207D-01	3.616D-01	7.286D-02	6.368D-02	5.695D-03
3.40D 03	1.492D 00	6.829D-01	3.138D-01	3.548D-01	7.166D-02	6.338D-02	5.890D-03
3.50D 03	1.463D 00	6.674D-01	3.072D-01	3.483D-01	7.053D-02	6.304D-02	6.074D-03
3.60D 03	1.434D 00	6.526D-01	3.009D-01	3.420D-01	6.946D-02	6.267D-02	6.248D-03
3.70D 03	1.407D 00	6.386D-01	2.949D-01	3.359D-01	6.845D-02	6.228D-02	6.412D-03
3.80D 03	1.380D 00	6.251D-01	2.891D-01	3.301D-01	6.749D-02	6.188D-02	6.567D-03
3.90D 03	1.355D 00	6.123D-01	2.836D-01	3.245D-01	6.659D-02	6.146D-02	6.714D-03
4.00D 03	1.331D 00	6.001D-01	2.783D-01	3.191D-01	6.574D-02	6.104D-02	6.854D-03
4.10D 03	1.308D 00	5.882D-01	2.732D-01	3.139D-01	6.494D-02	6.061D-02	6.984D-03
4.20D 03	1.286D 00	5.770D-01	2.684D-01	3.089D-01	6.416D-02	6.018D-02	7.097D-03
4.30D 03	1.264D 00	5.662D-01	2.637D-01	3.041D-01	6.340D-02	5.974D-02	7.204D-03
4.40D 03	1.244D 00	5.558D-01	2.592D-01	2.994D-01	6.266D-02	5.931D-02	7.304D-03
4.50D 03	1.224D 00	5.459D-01	2.548D-01	2.948D-01	6.193D-02	5.888D-02	7.399D-03
4.60D 03	1.205D 00	5.363D-01	2.507D-01	2.905D-01	6.122D-02	5.846D-02	7.488D-03

TABLE 28-STOPPING POWER OF ALUMINUM OXIDE (DENSITY 4.05G/CM3) FOR ELECTRONS

ELECTRON ENERGY EV	STOPPING POWER EV/A	INDIVIDUAL CONTRIBUTIONS TO THE STOPPING POWER IN UNITS OF EV/A					
		VAL(9EV)	VAL(29EV)	AL(2P)	AL(2S)	O(1S)	AL(1S)
4.70D 03	1.186D 00	5.271D-01	2.466D-01	2.862D-01	6.052D-02	5.804D-02	7.569D-03
4.80D 03	1.168D 00	5.182D-01	2.428D-01	2.821D-01	5.984D-02	5.763D-02	7.643D-03
4.90D 03	1.151D 00	5.097D-01	2.390D-01	2.781D-01	5.916D-02	5.723D-02	7.692D-03
5.00D 03	1.134D 00	5.014D-01	2.354D-01	2.742D-01	5.851D-02	5.683D-02	7.739D-03
5.10D 03	1.118D 00	4.934D-01	2.319D-01	2.705D-01	5.786D-02	5.645D-02	7.781D-03
5.20D 03	1.102D 00	4.858D-01	2.285D-01	2.668D-01	5.723D-02	5.607D-02	7.818D-03
5.30D 03	1.087D 00	4.783D-01	2.252D-01	2.633D-01	5.662D-02	5.570D-02	7.856D-03
5.40D 03	1.072D 00	4.711D-01	2.220D-01	2.599D-01	5.601D-02	5.534D-02	7.882D-03
5.50D 03	1.058D 00	4.642D-01	2.189D-01	2.565D-01	5.542D-02	5.499D-02	7.909D-03
5.60D 03	1.044D 00	4.574D-01	2.159D-01	2.533D-01	5.485D-02	5.465D-02	7.933D-03
5.70D 03	1.031D 00	4.508D-01	2.130D-01	2.501D-01	5.428D-02	5.432D-02	7.953D-03
5.80D 03	1.017D 00	4.445D-01	2.102D-01	2.470D-01	5.373D-02	5.400D-02	7.970D-03
5.90D 03	1.005D 00	4.384D-01	2.074D-01	2.441D-01	5.320D-02	5.369D-02	7.985D-03
6.00D 03	9.924D-01	4.324D-01	2.048D-01	2.411D-01	5.267D-02	5.338D-02	7.996D-03
6.10D 03	9.803D-01	4.266D-01	2.022D-01	2.383D-01	5.215D-02	5.309D-02	8.005D-03
6.20D 03	9.687D-01	4.210D-01	1.997D-01	2.355D-01	5.165D-02	5.280D-02	8.011D-03
6.30D 03	9.573D-01	4.156D-01	1.972D-01	2.329D-01	5.115D-02	5.252D-02	8.012D-03
6.40D 03	9.462D-01	4.102D-01	1.948D-01	2.302D-01	5.067D-02	5.225D-02	8.015D-03
6.50D 03	9.354D-01	4.051D-01	1.925D-01	2.277D-01	5.019D-02	5.199D-02	8.015D-03
6.60D 03	9.249D-01	4.000D-01	1.902D-01	2.252D-01	4.973D-02	5.174D-02	8.014D-03
6.70D 03	9.147D-01	3.952D-01	1.880D-01	2.227D-01	4.927D-02	5.149D-02	8.013D-03
6.80D 03	9.047D-01	3.904D-01	1.859D-01	2.204D-01	4.881D-02	5.124D-02	8.011D-03
6.90D 03	8.949D-01	3.857D-01	1.838D-01	2.180D-01	4.837D-02	5.101D-02	8.007D-03
7.00D 03	8.854D-01	3.812D-01	1.818D-01	2.158D-01	4.794D-02	5.078D-02	8.002D-03
7.10D 03	8.762D-01	3.768D-01	1.798D-01	2.135D-01	4.750D-02	5.056D-02	7.995D-03
7.20D 03	8.671D-01	3.725D-01	1.778D-01	2.114D-01	4.708D-02	5.034D-02	7.987D-03
7.30D 03	8.582D-01	3.683D-01	1.759D-01	2.093D-01	4.666D-02	5.013D-02	7.978D-03
7.40D 03	8.496D-01	3.642D-01	1.741D-01	2.072D-01	4.625D-02	4.992D-02	7.968D-03
7.50D 03	8.411D-01	3.602D-01	1.722D-01	2.052D-01	4.585D-02	4.972D-02	7.957D-03
7.60D 03	8.329D-01	3.563D-01	1.705D-01	2.032D-01	4.545D-02	4.953D-02	7.945D-03
7.70D 03	8.248D-01	3.525D-01	1.687D-01	2.012D-01	4.505D-02	4.934D-02	7.933D-03
7.80D 03	8.169D-01	3.488D-01	1.670D-01	1.994D-01	4.466D-02	4.916D-02	7.919D-03
7.90D 03	8.092D-01	3.451D-01	1.654D-01	1.975D-01	4.428D-02	4.898D-02	7.906D-03
8.00D 03	8.016D-01	3.416D-01	1.638D-01	1.957D-01	4.391D-02	4.881D-02	7.891D-03
8.10D 03	7.942D-01	3.381D-01	1.622D-01	1.939D-01	4.354D-02	4.864D-02	7.876D-03
8.20D 03	7.869D-01	3.347D-01	1.606D-01	1.921D-01	4.317D-02	4.848D-02	7.860D-03
8.30D 03	7.799D-01	3.314D-01	1.591D-01	1.904D-01	4.282D-02	4.832D-02	7.844D-03
8.40D 03	7.729D-01	3.281D-01	1.576D-01	1.887D-01	4.247D-02	4.816D-02	7.827D-03
8.50D 03	7.661D-01	3.249D-01	1.561D-01	1.871D-01	4.213D-02	4.800D-02	7.810D-03
8.60D 03	7.594D-01	3.218D-01	1.547D-01	1.855D-01	4.179D-02	4.784D-02	7.792D-03
8.70D 03	7.528D-01	3.187D-01	1.533D-01	1.839D-01	4.146D-02	4.767D-02	7.773D-03
8.80D 03	7.463D-01	3.157D-01	1.519D-01	1.823D-01	4.113D-02	4.750D-02	7.755D-03
8.90D 03	7.400D-01	3.128D-01	1.506D-01	1.808D-01	4.081D-02	4.734D-02	7.735D-03
9.00D 03	7.338D-01	3.099D-01	1.493D-01	1.793D-01	4.049D-02	4.717D-02	7.715D-03
9.10D 03	7.277D-01	3.071D-01	1.480D-01	1.778D-01	4.019D-02	4.700D-02	7.695D-03
9.20D 03	7.218D-01	3.043D-01	1.467D-01	1.764D-01	3.988D-02	4.683D-02	7.675D-03
9.30D 03	7.159D-01	3.016D-01	1.455D-01	1.750D-01	3.958D-02	4.666D-02	7.654D-03
9.40D 03	7.101D-01	2.989D-01	1.442D-01	1.736D-01	3.929D-02	4.649D-02	7.633D-03
9.50D 03	7.045D-01	2.963D-01	1.430D-01	1.722D-01	3.900D-02	4.632D-02	7.611D-03
9.60D 03	6.989D-01	2.938D-01	1.418D-01	1.709D-01	3.871D-02	4.614D-02	7.590D-03
9.70D 03	6.934D-01	2.912D-01	1.407D-01	1.695D-01	3.843D-02	4.597D-02	7.568D-03
9.80D 03	6.880D-01	2.888D-01	1.395D-01	1.682D-01	3.815D-02	4.580D-02	7.546D-03
9.90D 03	6.828D-01	2.864D-01	1.384D-01	1.670D-01	3.788D-02	4.563D-02	7.524D-03
1.00D 04	6.776D-01	2.840D-01	1.373D-01	1.657D-01	3.761D-02	4.546D-02	7.502D-03

ELECTRON ENERGY EV	CSDA RANGE (E TO 10EV) A	MEAN SQUARE ENERGY LOSS EV2/A	MEAN SQUARE RANGE FLUCTUATION A2	RELATIVE RANGE STRAGGLING
1.10D 01	2.732D 01	5.560D-01	7.703D 03	3.212D 00
1.20D 01	4.043D 01	9.642D-01	9.402D 03	2.398D 00
1.30D 01	4.892D 01	1.415D 00	1.013D 04	2.057D 00
1.40D 01	5.514D 01	1.905D 00	1.052D 04	1.860D 00
1.50D 01	6.003D 01	2.436D 00	1.078D 04	1.729D 00
1.60D 01	6.402D 01	3.013D 00	1.095D 04	1.635D 00
1.70D 01	6.738D 01	3.638D 00	1.108D 04	1.562D 00
1.80D 01	7.026D 01	4.314D 00	1.117D 04	1.504D 00
1.90D 01	7.277D 01	5.047D 00	1.124D 04	1.457D 00
2.00D 01	7.500D 01	5.837D 00	1.130D 04	1.418D 00
2.10D 01	7.697D 01	6.698D 00	1.135D 04	1.384D 00
2.20D 01	7.875D 01	7.616D 00	1.139D 04	1.355D 00
2.30D 01	8.036D 01	8.589D 00	1.143D 04	1.330D 00
2.40D 01	8.183D 01	9.613D 00	1.146D 04	1.308D 00
2.50D 01	8.318D 01	1.069D 01	1.148D 04	1.288D 00
2.60D 01	8.443D 01	1.180D 01	1.150D 04	1.270D 00
2.70D 01	8.559D 01	1.295D 01	1.152D 04	1.254D 00
2.80D 01	8.668D 01	1.414D 01	1.154D 04	1.239D 00
2.90D 01	8.770D 01	1.534D 01	1.155D 04	1.226D 00
3.00D 01	8.867D 01	1.658D 01	1.157D 04	1.213D 00
3.20D 01	9.042D 01	2.005D 01	1.159D 04	1.191D 00
3.40D 01	9.195D 01	2.379D 01	1.161D 04	1.172D 00
3.60D 01	9.331D 01	2.772D 01	1.163D 04	1.156D 00
3.80D 01	9.455D 01	3.176D 01	1.164D 04	1.141D 00
4.00D 01	9.568D 01	3.586D 01	1.166D 04	1.128D 00
4.20D 01	9.671D 01	4.137D 01	1.167D 04	1.117D 00
4.40D 01	9.765D 01	4.698D 01	1.168D 04	1.107D 00
4.60D 01	9.851D 01	5.261D 01	1.168D 04	1.097D 00
4.80D 01	9.932D 01	5.821D 01	1.169D 04	1.089D 00
5.00D 01	1.001D 02	6.372D 01	1.170D 04	1.081D 00
5.20D 01	1.008D 02	7.061D 01	1.170D 04	1.073D 00
5.40D 01	1.014D 02	7.746D 01	1.171D 04	1.067D 00
5.60D 01	1.021D 02	8.416D 01	1.171D 04	1.060D 00
5.80D 01	1.027D 02	9.068D 01	1.172D 04	1.054D 00
6.00D 01	1.032D 02	9.699D 01	1.172D 04	1.049D 00
6.20D 01	1.038D 02	1.039D 02	1.173D 04	1.044D 00
6.40D 01	1.043D 02	1.106D 02	1.173D 04	1.038D 00
6.60D 01	1.048D 02	1.172D 02	1.173D 04	1.034D 00
6.80D 01	1.053D 02	1.235D 02	1.174D 04	1.029D 00
7.00D 01	1.057D 02	1.296D 02	1.174D 04	1.025D 00
7.20D 01	1.062D 02	1.356D 02	1.174D 04	1.020D 00
7.40D 01	1.066D 02	1.415D 02	1.175D 04	1.016D 00
7.60D 01	1.071D 02	1.472D 02	1.175D 04	1.012D 00
7.80D 01	1.075D 02	1.527D 02	1.175D 04	1.009D 00
8.00D 01	1.079D 02	1.580D 02	1.175D 04	1.005D 00
8.20D 01	1.083D 02	1.630D 02	1.176D 04	1.001D 00
8.40D 01	1.087D 02	1.679D 02	1.176D 04	9.976D-01
8.60D 01	1.091D 02	1.728D 02	1.176D 04	9.941D-01
8.80D 01	1.095D 02	1.778D 02	1.177D 04	9.908D-01
9.00D 01	1.099D 02	1.827D 02	1.177D 04	9.875D-01
9.20D 01	1.102D 02	1.871D 02	1.177D 04	9.842D-01

TABLE 2C-CSDA RANGE AND STRAGGLING OF ELECTRONS IN AL2O3 (DENSITY 4.05G/CM3)

ELECTRON ENERGY EV	CSDA RANGE (E TO 10EV) A	MEAN SQUARE ENERGY LOSS EV2/A	MEAN SQUARE RANGE FLUCTUATION A2	RELATIVE RANGE STRAGGLING
9.400D 01	1.106D 02	1.915D 02	1.177D 04	9.810D-01
9.60D 01	1.110D 02	1.959D 02	1.177D 04	9.779D-01
9.80D 01	1.113D 02	2.003D 02	1.178D 04	9.749D-01
1.00D 02	1.117D 02	2.045D 02	1.178D 04	9.719D-01
1.10D 02	1.134D 02	2.418D 02	1.179D 04	9.576D-01
1.20D 02	1.151D 02	2.562D 02	1.180D 04	9.442D-01
1.30D 02	1.167D 02	2.691D 02	1.181D 04	9.316D-01
1.40D 02	1.183D 02	2.811D 02	1.182D 04	9.195D-01
1.50D 02	1.198D 02	2.923D 02	1.184D 04	9.078D-01
1.60D 02	1.214D 02	3.026D 02	1.185D 04	8.965D-01
1.70D 02	1.230D 02	3.118D 02	1.186D 04	8.854D-01
1.80D 02	1.246D 02	3.202D 02	1.187D 04	8.745D-01
1.90D 02	1.262D 02	3.278D 02	1.189D 04	8.639D-01
2.00D 02	1.278D 02	3.345D 02	1.190D 04	8.535D-01
2.10D 02	1.294D 02	3.411D 02	1.191D 04	8.433D-01
2.20D 02	1.311D 02	3.476D 02	1.193D 04	8.333D-01
2.30D 02	1.327D 02	3.534D 02	1.195D 04	8.234D-01
2.40D 02	1.344D 02	3.589D 02	1.196D 04	8.138D-01
2.50D 02	1.361D 02	3.642D 02	1.198D 04	8.043D-01
2.60D 02	1.378D 02	3.691D 02	1.200D 04	7.949D-01
2.70D 02	1.395D 02	3.738D 02	1.202D 04	7.858D-01
2.80D 02	1.412D 02	3.777D 02	1.204D 04	7.767D-01
2.90D 02	1.430D 02	3.813D 02	1.206D 04	7.679D-01
3.00D 02	1.448D 02	3.847D 02	1.208D 04	7.592D-01
3.10D 02	1.465D 02	3.881D 02	1.210D 04	7.506D-01
3.20D 02	1.484D 02	3.912D 02	1.212D 04	7.422D-01
3.30D 02	1.502D 02	3.941D 02	1.215D 04	7.339D-01
3.40D 02	1.520D 02	3.967D 02	1.217D 04	7.257D-01
3.50D 02	1.539D 02	3.992D 02	1.220D 04	7.177D-01
3.60D 02	1.558D 02	4.015D 02	1.222D 04	7.098D-01
3.70D 02	1.576D 02	4.039D 02	1.225D 04	7.021D-01
3.80D 02	1.596D 02	4.061D 02	1.228D 04	6.944D-01
3.90D 02	1.615D 02	4.081D 02	1.231D 04	6.870D-01
4.00D 02	1.634D 02	4.101D 02	1.234D 04	6.796D-01
4.10D 02	1.654D 02	4.136D 02	1.237D 04	6.724D-01
4.20D 02	1.674D 02	4.152D 02	1.240D 04	6.652D-01
4.30D 02	1.694D 02	4.168D 02	1.244D 04	6.583D-01
4.40D 02	1.714D 02	4.182D 02	1.247D 04	6.514D-01
4.50D 02	1.735D 02	4.195D 02	1.251D 04	6.446D-01
4.60D 02	1.755D 02	4.208D 02	1.254D 04	6.380D-01
4.70D 02	1.776D 02	4.220D 02	1.258D 04	6.315D-01
4.80D 02	1.797D 02	4.231D 02	1.262D 04	6.251D-01
4.90D 02	1.818D 02	4.241D 02	1.266D 04	6.188D-01
5.00D 02	1.840D 02	4.250D 02	1.270D 04	6.126D-01
5.10D 02	1.861D 02	4.258D 02	1.274D 04	6.065D-01
5.20D 02	1.883D 02	4.267D 02	1.279D 04	6.005D-01
5.30D 02	1.905D 02	4.275D 02	1.283D 04	5.947D-01
5.40D 02	1.927D 02	4.282D 02	1.288D 04	5.889D-01
5.50D 02	1.950D 02	4.289D 02	1.293D 04	5.832D-01
5.60D 02	1.972D 02	4.296D 02	1.298D 04	5.777D-01
5.70D 02	1.995D 02	4.304D 02	1.303D 04	5.722D-01

TABLE 20-CSDA RANGE AND STRAGGLING OF ELECTRONS IN AL2O3 (DENSITY 4.05G/CM3)

ELECTRON ENERGY EV	CSDA RANGE (E TO 10EV) A	MEAN SQUARE ENERGY LOSS EV2/A	MEAN SQUARE RANGE FLUCTUATION A2	RELATIVE RANGE STRAGGLING
5.80D 02	2.018D 02	4.313D 02	1.308D 04	5.668D-01
5.90D 02	2.041D 02	4.323D 02	1.313D 04	5.615D-01
6.00D 02	2.064D 02	4.332D 02	1.319D 04	5.563D-01
6.10D 02	2.088D 02	4.341D 02	1.324D 04	5.513D-01
6.20D 02	2.111D 02	4.350D 02	1.330D 04	5.463D-01
6.30D 02	2.135D 02	4.359D 02	1.336D 04	5.414D-01
6.40D 02	2.159D 02	4.369D 02	1.342D 04	5.365D-01
6.50D 02	2.183D 02	4.378D 02	1.348D 04	5.318D-01
6.60D 02	2.208D 02	4.387D 02	1.355D 04	5.272D-01
6.70D 02	2.232D 02	4.396D 02	1.361D 04	5.226D-01
6.80D 02	2.257D 02	4.404D 02	1.368D 04	5.182D-01
6.90D 02	2.282D 02	4.411D 02	1.375D 04	5.138D-01
7.00D 02	2.307D 02	4.418D 02	1.382D 04	5.095D-01
7.10D 02	2.333D 02	4.425D 02	1.389D 04	5.052D-01
7.20D 02	2.358D 02	4.432D 02	1.396D 04	5.011D-01
7.30D 02	2.384D 02	4.438D 02	1.404D 04	4.970D-01
7.40D 02	2.410D 02	4.445D 02	1.411D 04	4.930D-01
7.50D 02	2.436D 02	4.452D 02	1.419D 04	4.891D-01
7.60D 02	2.462D 02	4.459D 02	1.427D 04	4.853D-01
7.70D 02	2.488D 02	4.465D 02	1.436D 04	4.815D-01
7.80D 02	2.515D 02	4.472D 02	1.444D 04	4.778D-01
7.90D 02	2.542D 02	4.478D 02	1.453D 04	4.742D-01
8.00D 02	2.569D 02	4.484D 02	1.461D 04	4.706D-01
8.10D 02	2.596D 02	4.490D 02	1.470D 04	4.671D-01
8.20D 02	2.623D 02	4.491D 02	1.479D 04	4.637D-01
8.30D 02	2.650D 02	4.496D 02	1.489D 04	4.603D-01
8.40D 02	2.678D 02	4.501D 02	1.498D 04	4.570D-01
8.50D 02	2.706D 02	4.506D 02	1.508D 04	4.538D-01
8.60D 02	2.734D 02	4.510D 02	1.518D 04	4.506D-01
8.70D 02	2.762D 02	4.515D 02	1.528D 04	4.475D-01
8.80D 02	2.790D 02	4.519D 02	1.538D 04	4.445D-01
8.90D 02	2.819D 02	4.523D 02	1.548D 04	4.415D-01
9.00D 02	2.847D 02	4.526D 02	1.559D 04	4.385D-01
9.10D 02	2.876D 02	4.530D 02	1.570D 04	4.356D-01
9.20D 02	2.905D 02	4.533D 02	1.581D 04	4.328D-01
9.30D 02	2.935D 02	4.537D 02	1.592D 04	4.300D-01
9.40D 02	2.964D 02	4.540D 02	1.604D 04	4.273D-01
9.50D 02	2.993D 02	4.543D 02	1.616D 04	4.246D-01
9.60D 02	3.023D 02	4.546D 02	1.628D 04	4.220D-01
9.70D 02	3.053D 02	4.549D 02	1.640D 04	4.194D-01
9.80D 02	3.083D 02	4.551D 02	1.652D 04	4.169D-01
9.90D 02	3.113D 02	4.554D 02	1.665D 04	4.144D-01
1.00D 03	3.144D 02	4.556D 02	1.678D 04	4.120D-01
1.05D 03	3.299D 02	4.567D 02	1.745D 04	4.005D-01
1.10D 03	3.458D 02	4.575D 02	1.819D 04	3.900D-01
1.15D 03	3.621D 02	4.579D 02	1.899D 04	3.805D-01
1.20D 03	3.789D 02	4.582D 02	1.985D 04	3.719D-01
1.25D 03	3.961D 02	4.585D 02	2.078D 04	3.640D-01
1.30D 03	4.137D 02	4.588D 02	2.178D 04	3.568D-01
1.35D 03	4.317D 02	4.591D 02	2.285D 04	3.502D-01
1.40D 03	4.501D 02	4.588D 02	2.400D 04	3.442D-01

TABLE 2C-CSDA RANGE AND STRAGGLING OF ELECTRONS IN AL2O3 (DENSITY 4.05G/CM3)

ELECTRON ENERGY EV	CSDA RANGE (E TO 10EV) A	MEAN SQUARE ENERGY LOSS EV2/A	MEAN SQUARE RANGE FLUCTUATION A2	RELATIVE RANGE STRAGGLING
1.45D 03	4.689D 02	4.587D 02	2.523D 04	3.387D-01
1.50D 03	4.802D 02	4.586D 02	2.654D 04	3.337D-01
1.55D 03	5.078D 02	4.584D 02	2.793D 04	3.291D-01
1.60D 03	5.279D 02	4.583D 02	2.940D 04	3.248D-01
1.65D 03	5.483D 02	4.584D 02	3.097D 04	3.210D-01
1.70D 03	5.691D 02	4.584D 02	3.263D 04	3.174D-01
1.75D 03	5.904D 02	4.585D 02	3.438D 04	3.141D-01
1.80D 03	6.120D 02	4.585D 02	3.623D 04	3.110D-01
1.85D 03	6.340D 02	4.585D 02	3.819D 04	3.082D-01
1.90D 03	6.564D 02	4.585D 02	4.025D 04	3.057D-01
1.95D 03	6.792D 02	4.585D 02	4.242D 04	3.033D-01
2.00D 03	7.023D 02	4.585D 02	4.470D 04	3.010D-01
2.05D 03	7.259D 02	4.583D 02	4.710D 04	2.990D-01
2.10D 03	7.498D 02	4.579D 02	4.961D 04	2.970D-01
2.15D 03	7.741D 02	4.574D 02	5.224D 04	2.952D-01
2.20D 03	7.988D 02	4.570D 02	5.499D 04	2.936D-01
2.25D 03	8.239D 02	4.566D 02	5.788D 04	2.920D-01
2.30D 03	8.494D 02	4.561D 02	6.088D 04	2.905D-01
2.35D 03	8.752D 02	4.557D 02	6.403D 04	2.891D-01
2.40D 03	9.014D 02	4.552D 02	6.730D 04	2.878D-01
2.45D 03	9.280D 02	4.548D 02	7.072D 04	2.866D-01
2.50D 03	9.549D 02	4.543D 02	7.427D 04	2.854D-01
2.55D 03	9.822D 02	4.539D 02	7.797D 04	2.843D-01
2.60D 03	1.010D 03	4.534D 02	8.182D 04	2.832D-01
2.65D 03	1.038D 03	4.531D 02	8.581D 04	2.822D-01
2.70D 03	1.066D 03	4.528D 02	8.996D 04	2.813D-01
2.75D 03	1.095D 03	4.524D 02	9.427D 04	2.804D-01
2.80D 03	1.124D 03	4.520D 02	9.873D 04	2.795D-01
2.85D 03	1.154D 03	4.516D 02	1.034D 05	2.787D-01
2.90D 03	1.183D 03	4.512D 02	1.082D 05	2.779D-01
2.95D 03	1.214D 03	4.509D 02	1.131D 05	2.771D-01
3.00D 03	1.244D 03	4.505D 02	1.182D 05	2.764D-01
3.10D 03	1.306D 03	4.498D 02	1.290D 05	2.750D-01
3.20D 03	1.370D 03	4.492D 02	1.406D 05	2.737D-01
3.30D 03	1.435D 03	4.486D 02	1.529D 05	2.725D-01
3.40D 03	1.501D 03	4.480D 02	1.659D 05	2.714D-01
3.50D 03	1.569D 03	4.475D 02	1.798D 05	2.703D-01
3.60D 03	1.638D 03	4.469D 02	1.946D 05	2.693D-01
3.70D 03	1.708D 03	4.464D 02	2.102D 05	2.684D-01
3.80D 03	1.780D 03	4.459D 02	2.267D 05	2.675D-01
3.90D 03	1.853D 03	4.454D 02	2.441D 05	2.666D-01
4.00D 03	1.928D 03	4.449D 02	2.625D 05	2.658D-01
4.10D 03	2.003D 03	4.444D 02	2.818D 05	2.650D-01
4.20D 03	2.081D 03	4.440D 02	3.022D 05	2.642D-01
4.30D 03	2.159D 03	4.435D 02	3.236D 05	2.635D-01
4.40D 03	2.239D 03	4.430D 02	3.461D 05	2.628D-01
4.50D 03	2.320D 03	4.425D 02	3.697D 05	2.621D-01
4.60D 03	2.402D 03	4.420D 02	3.944D 05	2.614D-01
4.70D 03	2.486D 03	4.416D 02	4.203D 05	2.608D-01
4.80D 03	2.571D 03	4.411D 02	4.473D 05	2.602D-01
4.90D 03	2.657D 03	4.406D 02	4.756D 05	2.596D-01

ELECTRON ENERGY EV	CSDA RANGE (E TO 10EV) A	MEAN SQUARE ENERGY LOSS EV2/A	MEAN SQUARE RANGE FLUCTUATION A2	RELATIVE RANGE STRAGGLING
5.00D 03	2.745D 03	4.401D 02	5.052D 05	2.590D-01
5.10D 03	2.833D 03	4.396D 02	5.360D 05	2.584D-01
5.20D 03	2.924D 03	4.391D 02	5.681D 05	2.578D-01
5.30D 03	3.015D 03	4.386D 02	6.016D 05	2.573D-01
5.40D 03	3.108D 03	4.381D 02	6.364D 05	2.567D-01
5.50D 03	3.201D 03	4.371D 02	6.727D 05	2.562D-01
5.60D 03	3.297D 03	4.366D 02	7.103D 05	2.557D-01
5.70D 03	3.393D 03	4.362D 02	7.494D 05	2.551D-01
5.80D 03	3.491D 03	4.357D 02	7.900D 05	2.546D-01
5.90D 03	3.590D 03	4.353D 02	8.322D 05	2.541D-01
6.00D 03	3.690D 03	4.349D 02	8.759D 05	2.536D-01
6.10D 03	3.791D 03	4.345D 02	9.212D 05	2.532D-01
6.20D 03	3.894D 03	4.342D 02	9.681D 05	2.527D-01
6.30D 03	3.998D 03	4.338D 02	1.017D 06	2.522D-01
6.40D 03	4.103D 03	4.335D 02	1.067D 06	2.518D-01
6.50D 03	4.209D 03	4.332D 02	1.119D 06	2.513D-01
6.60D 03	4.316D 03	4.329D 02	1.173D 06	2.509D-01
6.70D 03	4.425D 03	4.326D 02	1.229D 06	2.505D-01
6.80D 03	4.535D 03	4.323D 02	1.286D 06	2.501D-01
6.90D 03	4.646D 03	4.320D 02	1.345D 06	2.496D-01
7.00D 03	4.759D 03	4.317D 02	1.407D 06	2.492D-01
7.10D 03	4.872D 03	4.315D 02	1.470D 06	2.488D-01
7.20D 03	4.987D 03	4.312D 02	1.535D 06	2.484D-01
7.30D 03	5.103D 03	4.310D 02	1.602D 06	2.480D-01
7.40D 03	5.220D 03	4.307D 02	1.671D 06	2.477D-01
7.50D 03	5.338D 03	4.305D 02	1.743D 06	2.473D-01
7.60D 03	5.458D 03	4.302D 02	1.816D 06	2.469D-01
7.70D 03	5.578D 03	4.300D 02	1.891D 06	2.465D-01
7.80D 03	5.700D 03	4.298D 02	1.969D 06	2.462D-01
7.90D 03	5.823D 03	4.295D 02	2.049D 06	2.458D-01
8.00D 03	5.947D 03	4.293D 02	2.131D 06	2.455D-01
8.10D 03	6.073D 03	4.291D 02	2.216D 06	2.451D-01
8.20D 03	6.199D 03	4.289D 02	2.303D 06	2.448D-01
8.30D 03	6.327D 03	4.288D 02	2.392D 06	2.444D-01
8.40D 03	6.456D 03	4.286D 02	2.484D 06	2.441D-01
8.50D 03	6.586D 03	4.284D 02	2.578D 06	2.438D-01
8.60D 03	6.717D 03	4.283D 02	2.674D 06	2.435D-01
8.70D 03	6.849D 03	4.281D 02	2.773D 06	2.431D-01
8.80D 03	6.982D 03	4.279D 02	2.875D 06	2.428D-01
8.90D 03	7.117D 03	4.278D 02	2.979D 06	2.425D-01
9.00D 03	7.253D 03	4.276D 02	3.086D 06	2.422D-01
9.10D 03	7.389D 03	4.274D 02	3.195D 06	2.419D-01
9.20D 03	7.527D 03	4.273D 02	3.308D 06	2.416D-01
9.30D 03	7.667D 03	4.271D 02	3.423D 06	2.413D-01
9.40D 03	7.807D 03	4.270D 02	3.541D 06	2.410D-01
9.50D 03	7.948D 03	4.268D 02	3.661D 06	2.407D-01
9.60D 03	8.091D 03	4.267D 02	3.785D 06	2.405D-01
9.70D 03	8.234D 03	4.265D 02	3.911D 06	2.402D-01
9.80D 03	8.379D 03	4.263D 02	4.041D 06	2.399D-01
9.90D 03	8.525D 03	4.262D 02	4.173D 06	2.396D-01
1.00D 04	8.672D 03	4.260D 02	4.309D 06	2.394D-01