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# Chemical Effects in the Corrosion of Aluminum and Aluminum Alloys

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Department of Chemistry  
The American University  
Washington, D.C. 20016

By  
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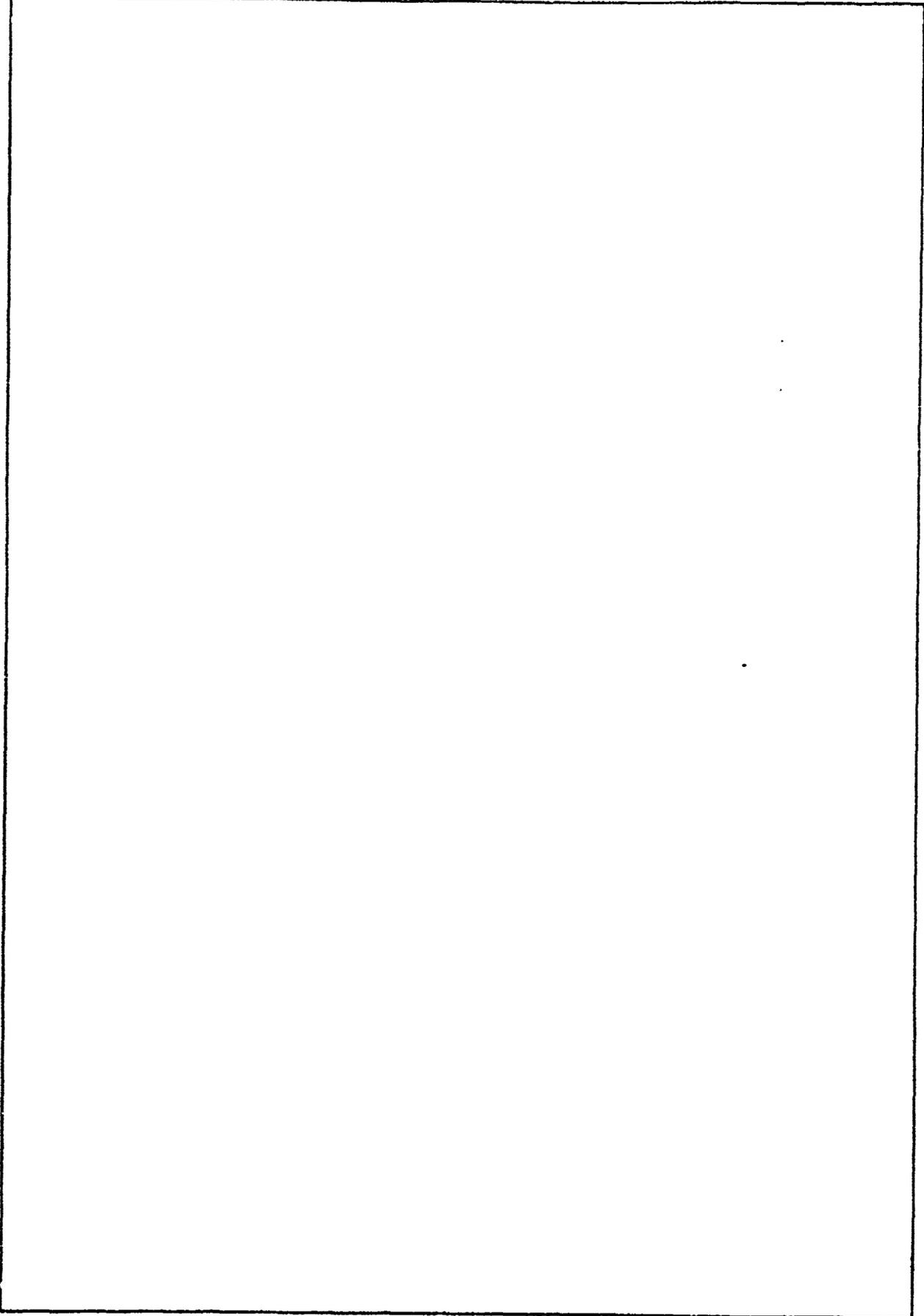
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"CHEMICAL EFFECTS IN THE CORROSION OF ALUMINUM AND  
ALUMINUM ALLOYS"

A Bibliography

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Bibliography of Literature on Chemical Effects  
in the Corrosion of Aluminum and Aluminum Alloys

Introduction

In 1969 a bibliography of the literature on chemical effects in the corrosion of aluminum and aluminum alloys was issued by this Laboratory. In that first survey the literature from the year 1913 and through the year 1968 was critically examined, specifically with reference to information on the influence of anions and other chemical species on the corrosion of aluminum. This first search served the basis for experimental investigations that have been conducted in our Laboratory from that year up to the present.

With this bibliography the literature is covered from 1968 through 1975. Thus the present search overlaps the first.

In the present bibliographic review, considerable attention is given to corrosion inhibitors, again to support experimental work being conducted in the Laboratory. An effort has been made to do some evaluation, that is, not all of the available references were included, only those, in the Author's opinion that offer pertinent information or would lead to sources that would be of value to the corrosion program.

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 The influence of aliphatic and aromatic acids on the corrosion and anodic behaviour of Al-2S.
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 A discussion of electrochemical methods of corrosion protection with respect to fundamental aspects, criteria of safe protections, and possible causes of failure.

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 Effects of some aldehydes on the corrosion of Al in 1.0 M HCl.
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 Inhibitive action of chromate ion on an Al surface was studied in  $10^{-4}$  M  $Na_2CrO_4$  (pH 6.5) radioactive soln. using Cr as a tracer.
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 Corrosion of Al and its alloys in underground areas in the presence of water, oil or steam at  $150^{\circ}$ .
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Significance of protection potential under conditions of restricted diffusion.
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Inhibitive action of 2-mercaptobenzothiazole against the corrosion of Cu, brass and Al in 0.1 N chloro-substituted acetic acid.
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A review showing the importance of Al, composition and performance of anode installation, principles and design aspects, recent applications and scope of the method,
- 1972-28 F.M. Rheinart, and J.E. Jenkins  
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 The effect of the juices and tea leaves on the dissolution of Al in 2N HCl and 1.5N NaOH.
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 Adsorption of Bu<sub>2</sub>S by Cu, mild steel, Zn and Al in N H<sub>2</sub>SO<sub>4</sub> using radioactive S.
- 1972-32 N. Subramanyan and M. Krishnan  
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 "Corrosion And Anodic Polarization Behaviour Of Aluminum In Sodium Hydroxide Soln Containing Sucrose Or Allied Products With Or Without Calcium"  
 The effect of sucrose, glucose, fructose, mannose, and mannitol on the corrosion and anodic polarization of Al-2S in M NaOH in the presence of Ca.
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 "Corrosion Potentials Of Some Common Metals In Oxygenated Solutions In Relation To Semiconductivity Of The Corrosion Films"  
 The role of estd. semicond. of corrosion films in the detn of the magnitudes of open-circuit corrosion potentials of Cu, Sn, Al, Ni, Fe, Zn and Pb in Cl<sup>-</sup> solutions.
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 A review on the anodic behaviour of metals based on thermodynamic, kinetic, and morphological conditions.
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 "Corrosion Of Aluminum And A Mg-3 and A Mts Alloys In Ch<sup>+</sup> Soln Containing Aqueous Solutions Of Ethylene Glycol"  
 An electrochemical evaluation of the corrosion resistance of Al and Al alloys in aq. ethylene glycol solns containing chloride ions.
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 Use of gas chromatography to study the corrosion of metals in water at high temperatures.
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 A review w/43 refs.
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 A review is given with 44 refs. on the corrosion of steels, Ti and Al alloys.
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 Use of alicyclic compounds as inhibitors for Al 3S in HCl.
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 "Effect Of External Anodic Polarization On The Efficiency Of Corrosion Inhibitors for Al Alloys in HCl"  
 An evaluation is given of various inhibitors, mostly amines. for Al alloys in HCl under the influence of ext. anodic pol.
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 Use of colloidal substances as corrosion inhibitors for Al in acetic and chloro-substituted acetic acids.

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 Effects of some ions in water on the number of corrosion pits and the depths of these pits on Al.
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 A method was given for detn. of the thickness of anodized layer on Al (7429-90-5) by measuring the intensity of changes in the diffuse reflected light from the dyed surface.
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 The mechanism of acid attack, the mechanism of corrosion inhibition and different types of corrosion inhibitors are discussed.
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 Presentation of the general aspects of scientific and technical problems of metal corrosion in the USSR.
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 Use of some thio compounds as corrosion inhibitors for 3S Al in 0.5 N HCl.

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 The corrosion inhibiting effects of aldehydes on the cor-  
 rosion of Al-3S in 0.5 N HCl.
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 in HCl solutions.
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 The influence of some organic thiocompounds on the corrosion  
 rate of 3S Al in 0.5 N HCl solutions.
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 Behavior Of A Columnar Al-Cu Alloy"  
 Evaluation of the morphology and kinetic nature of corrosion  
 of directionally solidified Al-4.5 wt% Cu.
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 Of Aluminum Alloys"  
 The mechanism of anodic dissoln. of various heat treated Al  
 alloys under plastic deformation was examd. in a 1% NH<sub>4</sub> borate  
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 The inhibitor effect of some phenols on the corrosion of Al-  
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Aluminum Intermetallic Cpds & The Corrosion Morphology  
Of Binary Aluminum Alloys"  
The potentials of binary Al alloys (Al-0.5% Fe, Al-0.5% Ni,  
Al - 0.5% Mn, & Al-4% Cu) & the polarization curves of pure  
Al (99.999% Al) & Al intermetallic cpds.
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Schweiz. Alum. Rundsch., 23, 201-6, (1973)  
"Corrosion & Surface Protection Of Aluminum Automatic Machine  
Alloys"  
The types of corrosion to which Al alloys are subject are re-  
viewed. Methods of protection are described with special ref.  
to anodizing. Applications of Al alloys in the food industry  
are given. No refs.

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 "Corrosion behaviour of aluminum in phosphate solutions"  
 The potential of the Al (7429 - 90 - 5) electrode was measured at 30° in  $5 \times 10^{-4}$  M aq. phosphate (14265 -44 -2) solns. as a function of pH and electrolyte concn.
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 "Influence of Copper Bicarbonate Ions on the Corrosion of Aluminum Alloy in Saline Solutions"  
 Corrosion rate studies of 3 Al. alloys (1100, 5052, 6063) were conducted in saline solns.
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 "Localized Corrosion of Al and its Alloys. I. Critical Potential,  $E_p$ , with respect to Pitting "  
 Determination of the critical potential for Al and its alloys with Si and Zn in 0.5 M NaCl at pH 2 and pH 6.
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 Corrosion of Al and its alloys in 0.5 M HCl and 0.5 M NaCl.
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 Study of N-substituted anilines as corrosion inhibitors for Indal 3S(11146-15-9) in HCl solns.
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Corrosion 30, 427, (1974)  
 "Use of Galvanokinetic Methods for the Determination of Characteristic Potentials for Pitting Corrosion on Aluminum"  
 Use of galvanokinetic methods to det. the pitting potential and protection potential against pitting for unalloyed Al in a deaerated soln of 3% NaCl at 0° and 30°.
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 "Effect of the Nature of a Solvent on the Inhibiting Effect of Some Organic Compounds in HCl-Alcohol Systems"  
 Use of pyridine derivatives or perylium perchlorates to inhibit corrosion of Fe, Al and Zn in 0.5-4.0 M HCl.
- 1974-8 F.E. Faller  
Korrosion, 25, 128-32, (1974)  
 "Corrosion behaviour of aluminum in sea water and brackish waters with special reference to shipbuilding conditions"  
 The importance of the low electro-chem. potential of Al. & phy. chem. properties of Al. oxide on the corrosion resistance of Al. are reviewed with 8 refs.

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Werkst. Korros., 25, 706-11, (1974)  
 "Corrosion inhibition mechanisms as compared to the inhibition mechanisms of other electrode reactions"  
 A review with 3 refs.
- 1974-10 R.J. Gesl and A. Troiano  
Corrosion, 3C, 274-9, (1974)  
 "Stress Corrosion and Hydrogen Embrittlement in an Aluminum Alloy"  
 A strain aging type of reversible H embrittlement was demonstrated for a high strength Al alloy in a 3% NaCl soln.
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 "Corrosion & stress corrosion, problems of aluminum structural alloys"  
 The corrosion behaviour of several structural alloys of Al. in different media is discussed.
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 "Mechanism of the Action of Aminochromates as Inhibitors of the Corrosion of Some Metals"  
 Mechanism of the action of aminochromates as inhibitors of the corrosion of steel, Al, Cu, and Cd.
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 "Behaviour of Al in NaOCl Solns"  
 Behaviour of aluminum (7429-90-5) in NaOCl solutions.
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 A review on the corrosion mechanism of Al and classification of corrosion inhibitors.
- 1974-15 T. Jangg, H. Meissner and R. Zuerner  
Aluminum Duesseldorf, 5G, 205-13, (1974)  
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 "Behaviour of Some Ketones and Ethers as Inhibitors of Corrosion of Aluminum in HCl and in NaOH Solution"  
 The effectiveness of some ketones and ethers as inhibitors of corrosion of Al(7429 -90 -5) in hydroxide soln and in HCl both in the presence and absence of Ca.

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 "Effect Of Magnesium On The Anodic Behavior Of Aluminum Magnesium Alloys In Alkaline Nitrate Solutions"  
 Mg effect on the corrosion rate of Al-Mg alloys in alk.-nitrate solns was determined by studying the anodic behavior of this system.
- 1974-18 B.S. Lee, M. Seno and T. Asahara  
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 "Vapor Phase Corrosion Inhibitors. 4. Effects Of Various Sub-Components On The Corrosion-Inhibiting Action Of Hexamerhylenetetramine On Aluminum"  
 Investigation of vapor-phase corrosion-inhibiting papers, powders, tables and oils for Al.
- 1974-19 R.T. Lawson  
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 The potential-pH-temp. relation for the Al-H<sub>2</sub>O system were calcd. by the methods of Bethune, Khodakovskiy, Criss & Cobble and Nelgeson & a crit. comparison made.
- 1974-20 T.J. Lennox, M.H. Peterson, J.A. Smith and R.E. Groover  
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 "Corrosion And Cathodic Protection Of 5086-H32 Aluminum Coupled To Dissimilar Metals"  
 Study of corrosion of 5086-H32 aluminum in various environments.
- 1974-21 H. Lommel  
Korrosion, 25, 29-34, (1974)  
 "Corrosion Behavior And Corrosion Protection Of Light Metal Alloys In Shipbuilding & Similar Applications"  
 The corrosion behavior of Al and its alloys in shipbuilding is reviewed with 7 refs. The effect of structure, compn., heat treatment, welding & contact with other metals is considered.
- 1974-22 V.A. Makavov  
Itogi Nauki Tekh. Korroz. Zashch. Korros., 3, 84, (1974)  
 "Anodic Electrochemical Protection"  
 A review w/194 refs.
- 1974-23 A. Maitra and S. Barua  
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 "Dicyandiamide. Inhibitor For Acid Corrosion Of Pure Aluminum"  
 Inhibition efficiency of dicyandiamide on Al in 0.5-2.0 N HCl at 27° for 1-6 hrs.

- 1974-24 M. Marek and R.F. Hochman  
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 "Stimulated Crevice Corrosion Expt. For pH And Solution Chemistry Determination"  
 Crevice corrosion in dental amalgam
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 "Aluminum. Corrosion And Metal Finishing Bibliography Of Publications"  
 A list of 83 papers published from the electrochem. labs of the world covering various aspects of the use of Al(7429-90-5).
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Indian Chem. Manuf., 12, 13, (1974)  
 "Corrosion Of Metal In Different Chemical Environments And Its Protection"  
 Corrosion of Al, steels and bronzes in acids, water, sea water, cutting oil emulsions, detergents, petroleum and org. solvents is reviewed.
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J. Inst.Chem. Calcutta, 46, Pt5, 167, (1974)  
 "Azoles As Corrosion Inhibitors For 3S Aluminum In Local Supply Water"  
 Use of 2-mercaptobenzothiazole and 2-mercaptobenzimidazole as corrosion inhibitors for 3S Al in Gujarat Univ supply water.
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 Statistical study of the corrosion of Al alloys in sea water and in an industrial atm for 5 yrs.
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 "Protection Of Metals And Light Alloys"  
 A review is given of industrial Al and Mg alloys and of corrosion and its prevention.
- 1974-30 N. Subramanyan and K. Ramakrishnaiah  
 Proc. Semin. Electrochem. 14th 1973, 375, (1974)  
 "Effect Of Some Amino Acids In The Corrosion Of Al In 1M HCl"  
 The influence of 10 amino acids on the corrosion of Al (7429-90-5) in 1 N HCl both in the presence and absence of Ca (7440-90-2).

- 1974-30 N. Subramanyan and K. Ramakrishnaiah  
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 "Effect Of Some Amino Acids In The Corrosion Of Al in 1M HCl"  
 The influence of amino acids on the corrosion of Al (7429-90-5) in 1 N HCl both in the presence and absence of Ca (7440-90-2).
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 "Corrosion Inhibitors"  
 Types of inhibitors and their applications in various chem. and environmental processes are reviewed.
- 1974-32 J.D. Talati and J.M. Pandya  
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 "Amines As Corrosion Inhibitors For B26S Al in H<sub>3</sub>PO<sub>4</sub>"  
 The inhibition of corrosion of Al-Cu (4%) alloy B26S in 0.1 N solns of H<sub>3</sub>PO<sub>4</sub> (7664-38-2) by different amines.
- 1974-33 S. Terai, Z. Tanabe and M. Hagiwara  
Suiyokai-Shi, 18, 80, (1974)  
 "Corrosion And Corrosion Control Of Aluminum And Its Alloys. I"  
 A review w/46 refs.
- 1974-34 S. Terai, Z. Tanabe and T. Suzuk  
Suiyokai-Shi, 18, 80, (1974)  
 "Corrosion And Corrosion Control In Aluminum And Its Alloys. II"  
 A review w/84 refs is given on cathodic protection of Al, corrosion inhibitors and corrosion protection by surface treatment.
- 1974-35 D.E. Taylor and R.B. Waterhouse  
Corros. Sci., 14, 111-22, (1974)  
 "Electrochemical Investigation Of Fretting Corrosion Of A Number Of Pure Metals In 0.5M Sodium Chloride"  
 Free potential measurement supplemented by transient linear polarization was used to study the effect of fretting corrosion on Zn, Al, Ag, Ta, Cu, Cr, and Ni in 0.5 M NaCl.
- 1974-36 E.D. Verink, Jr.  
Chem. Eng., 81, 104,106,108,110  
 "Aluminum Alloy For Saline Waters"  
 Work at an exptl. desalting plant shows that Al alloys can handle saline water with min. corrosion.

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