Use of Microporous Rubber Diaphragms in the Electrolytic Production of Manganese and Chlorine from Manganese Chloride Solutions Obtained from Ores

by V. Aravamuthan and S. Gopal

Central Electrochemical Research Institute, Karaikudi-3

In previous communications,[1,2] a process for electrolytic production of manganese and chlorine from manganese chloride solutions was described which involved the use of porcelain porous pots as diaphragms. Although porous porcelain vessels of suitable sizes can be used, yet it was felt that the use of microporous rubber diaphragms would find greater applicability for use on large scale.

These diaphragms are produced now in India to meet the demand as separators in the Storage Battery Industry. A simple design of anode box consists in fitting these microporous rubber sheets into wooden frames treated with chlorinated rubber paint. Such anode boxes can be built and utilised conveniently in sizes upto 16″ × 24″ × 2·5″. These boxes in any required number can be included in one (common) catholyte chamber to increase the capacity of the cell within reasonable limits to make the same attractive for industrial purposes. These rectangular anode boxes are provided at the top with the chlorine suction arrangement and passage for taking out graphite leads. In addition, provision is also made to note or change the anolyte level. Catholyte chamber, which is no other than the electrolytic vessel itself, is a wooden box suitably treated with chlorinated rubber paint. Stainless steel cathodes and graphite anodes are employed. In this contribution our experiences in a 16 amp. cell for the production of manganese metal and chlorine employing microporous rubber diaphragm anode boxes are given. Encouraging results have been obtained and therefore these show promise for large scale work.

DESCRIPTION OF THE CELL

The electrolytic vessel is a wooden box treated with chlorinated rubber paint and having the internal dimensions of 12″ × 8″ × 7·5″. Two anode boxes each having internal dimensions of 6″ × 1·8″ × 6·5″ were formed from two microporous rubber sheets of dimensions 6″ × 6·5″, fitted to wooden frames treated with chlorinated rubber paint. There is provision for sucking off chlorine from the anode chamber through the 0·25″ hole provided at the top wooden lid which is also treated with chlorinated rubber paint. In addition, there is also provision for noting the level of anolyte and also for feeding the anolyte through another 0·25″ hole. The graphite anode of size 5″ × 8″ × 1/8″ is kept in the anode box and projects through the slot provided in the wooden lid. Escape of chlorine through these holes and slot have been prevented by also painting them with rubber paint after inserting the electrodes, glass tubes etc. in proper positions.

Two such anode boxes are kept in the electrolytic vessel and in between them is kept a stainless steel cathode of dimensions 5″ × 8″ × 1/32″. Near one end of the cell and on a line parallel to the anode box or the cathode is kept a glass coil through which cold water is passed to maintain the temperature of the catholyte 30° to 33°C. On the other end of the wooden vessel is kept a stirrer. Provision is also made to feed manganese chloride solution having a concentration of Mn 58 g/l, ammonium chloride 120 g/l and SO_2 0·3 g/l. Rate of feeding is 200 cc per hour and an equal volume of electrolyte is withdrawn every hour. The volume of catholyte is 6000 cc having a manganese content of 18-19 g/l, ammonium chloride, 120 to130 g/l, and SO_2 0·3 g/l. Anolyte is a 30% solution of sodium chloride and 1200 cc of anolyte were placed in each anode box. Electrolysis is conducted at a temperature of 30 to 33°C. The cathode current density is 48 amp/sq. ft. The inter electrode distance is 4″ and the cell voltage 3·6. Thus all conditions were maintained identical as in previous experiments where porous porcelain pots were employed as diaphragms.

(*Continued on page 91*)

chemical process development, scaling up of chemical processes, chemical process equipment design, and operating experiences of chemical production plants. The organizers have plans to publish the proceedings. The following papers were contributed by members of the India Section: (1) Development of a Process and Plant for Manufacture of Potassium Chlorate, by S. Ramaswamy and N. Kalyanam, (2) Scale-up in the Design of Electrolytic Cells, Part II. Production of Salicylaldehyde by Reduction of Salicylic Acid, by S. Ganesan, K. S. Udupa, G. S. Subramanian and H. V. K. Udupa, and (4) Design Problems in Corrosion Engineering, by J. Sundararajan and T. L. Rama Char.

Power Sources Conference in the U. S. A.—Fuel and Heat Cells

Direct generation of electricity from fuel and heat is coming of age. The rapid development of fuel cells and thermal cells for the creation of electricity to the point of field testing with electronic equipment was emphasized at the 15th Annual Power Sources Conference held at Atlantic City, N. J., during May 1961. It was sponsored by the U. S. Army Signal Research and Development Lab., Fort Monmouth, N. J. An entire day was devoted to fuel cells, and half a day to thermal energy conversion. It was pointed out that despite some previous claims, fuel cells consuming such exotic fuels as hydrogen, oxygen and hydrogen peroxide, as well as more common substances such as hydrocarbons and alcohol, are not ready for general use. The same is true of thermal units. Solar energy conversion, primary and secondary conventional batteries were also discussed. Development of reliable high-rate zinc-silver-oxide batteries for missiles was announced, as were the latest developments in radiation-resistant solar cells for satellite power.—J. Electrochem. Soc. Vol 108, 141-C, 1961.

Second International Conference on Passivity

The Second International Conference on Passivity will be held in Canada in the fall of 1962. It will be sponsored by the Electrochemical Society, the Faraday Society, and the Deutsche Bunsen-Gesellschaft. It is proposed to publish the proceedings in a special edition of JECS.

Conference on Anodized Aluminium

The Aluminium Development Association, London, and the Dept. of Metallurgy, University of Nottingham organized a Conference on 'Anodized Aluminium' at the University from 12 to 14 September, 1961. The aim of the sessions was to discuss the latest technical developments as well as the fundamental aspects. Fifteen papers were presented by British and foreign authors, and preprints were made available.

—T.L.R.

(*Concluded from page 92*)

For efficient performance of the cell there is need to paint the microporous rubber diaphragms exposed above the catholyte level and also for keeping the catholyte just quarter inch above the painted level of the diaphragms. The anolyte level is kept roughly 3/4" above the catholyte level.

Under these circumstances it is established in the 16 amp. cell run continuously for 8 hours that the pH of the catholyte remains between 7 and 7·4. Practically the same current efficiency is obtained as in the previous experiments wherein porous pots were employed *viz.*, 56 to 60%.

ACKNOWLEDGEMENT

Our thanks are due to Professor K S.G. Doss, Director, Central Electrochemical Research Institute for his keen interest in the work and constant encouragement.

REFERENCES

1. Indian Mining Journal, **7**, 1, (1959), 5-8.
2. Journal of Mines, Metals and Fuels, **7**, 3, (1959), 30.