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Shchegolev, V.I. and Lebedev, O.A., *Elecktroliticheskoe poluchenie magniya* (Electrolytic Production of Magnesium), Moscow: Publ. House Ruda i Metally, 2002, 386 pp.

In the 1980s, the magnesium industry of the USSR was one of the most successfully developing segments of nonferrous metallurgy, highly competitive in its scientific and technological level with the similar industries abroad. There were three high-output-capacity titanium-magnesium combines and two magnesium plants in the country. The highest output of magnesium in the USSR in those years was up to 160 thousand tons a year, with 95 thousand tons consumed for titanium production by reduction of titanium tetrachloride with magnesium. The geopolitical changes which occurred in the 1990s resulted in that only two plants out of five remained on the territory of Russia in Perm oblast: titanium-magnesium combine (Berezniki) and magnesium plant (Solikamsk). Their rated output capacities are, respectively, 35 and 20 thousand tons of magnesium a year. The monograph by V.I. Shchegolev and O.A. Lebedev covers a wide range of issues associated with electrolytic manufacture of magnesium from various kinds of raw materials, including information about preprocessing of raw materials, choice of electrolyte, electrolyzer designs, refining of raw magnesium, production of magnesium alloys, and manufacture of high-purity metal. The book comprises an introduction, 15 chapters, a reference list for the entire monograph, and an appendix.

The brief introduction (pp. 3–8) presents evidence of mainly historical nature about magnesium production and creation of the domestic magnesium industry. The Dneprovskii magnesium plant was put into operation on December 23, 1935, and the Solikamsk magnesium plant, on March 10, 1936. The first chapter (pp. 8–17) describes the physicochemical properties of magnesium and its interaction with various reagents. The second chapter (pp. 17–25) summarizes the presently available data on the world production of primary and secondary magnesium and main fields of application of magnesium and its alloys. At present, approximately 80% of magnesium is obtained in the world's technological practice electrolytically, and up to 20% thermally. The largest manufacturer of magnesium in the world is the US. Special attention is given by the authors to the development of magnesium production in China in the recent decade. In 1997, China manufactured 80 thousand tons of magnesium, and the present magnesium production capacity of this country is estimated to be approximately 170 thousand tons. China has, in addition to rather large plants, up to 200 small plants producing magnesium by the thermal method.

The very small third chapter (pp. 27–32) briefly characterizes the main types of magnesium raw materials. The fourth chapter (pp. 32–52) discusses technological schemes for magnesium production by electrolysis, bath feeding with carnallite or magnesium chloride of varied origin, and work by a combined scheme. The fifth chapter (pp. 58–68) is devoted to phisicochemical aspects of the technology of dehydration of chloride-magnesium raw materials. The sixth (pp. 68–98) and seventh (pp. 98–109) chapters describe the apparatus and technology for dehydration of carnallite and crystal hydrates of magnesium chloride. The eighth chapter analyzes in detail various methods for purification of chloride-magnesium raw materials to remove various impurities. The main kind of Russia's raw materials for manufacture of commercial magnesium (Solikamsk magnesium plant) is dehydrated carnallite not subjected to any special treatment. At the same time, preliminary electrolyte purification is necessary for achieving high and stable characteristics on modern diaphragmless electrolyzers.

The ninth chapter (pp. 140–215) discusses the physicochemical properties of salt systems, used in deciding on the electrolyte composition, and formulates main requirements to an industrial electrolyte for ensuring a high current efficiency by magnesium and chlorine, the minimum voltage across the electrolyzer, and lowered sludge formation. The tenth and eleventh chapters (pp. 216–240 and 240–266) describe various designs of electrolyzers with and without diaphragm, analyze their advantages and disadvantages, and advise on how on technological processes are to be carried out, depending on electrolyzer design and type of magnesium-chlorine raw materials (carnallite, magnesium chloride). The twelfth chapter (pp. 267–294) considers possible directions of improvement of the apparatus-technological schemes for electrolytic pro-

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duction of magnesium. The authors mention among such directions creation of a flow-line technology of electrolysis and optimization and intensification of operation of a separate electrolyzer. The chapter also considers fundamentally new concepts of the technology and apparatus for electrolytic manufacture of magnesium and the technology for production of granulated magnesium and magnesium powders and discusses some ecological problems and, in particular, those associated with utilization of spent electrolyte.

The thirteenth chapter (pp. 294–316) is devoted to refining and casting of raw magnesium. It analyzes the reasons for the appearance of impurities, requirements imposed by standards on primary magnesium, and methods of its purification. The fourteenth chapter (pp. 316–324) presents evidence on production of magnesium alloys with manganese, zinc, aluminum, zirconium, and other alloying components. The same chapter discusses processing of scrap and waste aluminum alloys. The fifteenth chapter (pp. 324–345) is concerned with manufacture of high-purity magnesium.

The bibliography (pp. 345–357) contains references to 252 publications of mainly domestic authors. The appendix (pp. 358–363) presents evidence concerning the thermodynamic characteristics of various compounds of magnesium and a number of salts used as additives to the electrolyte of the magnesium bath.

The authors of the monograph did an ample amount of work on collecting, systematizing, and analyzing an extensive body of data, furnishing an exhaustive notion of the modern state of magnesium manufacture by electrolysis. The book reflects numerous investigations carried out by staff members of the All-Russia Aluminum-Magnesium Research and Design Institute (St. Petersburg), who made a major contribution to the creation of the domestic magnesium industry.

There is no escape from mentioning that the problem of whether or not it is appropriate to feed baths with dehydrated carnallite, which leads to batch electrolysis, was rather controversial when designing the Solikamsk magnesium plant. A.F. Antipin (1890–1960), one of leading specialists in electrometallurgy of light metals and a corresponding member of the Academy of Sciences of the USSR, believed till the end of his life that this decision was an error. In this connection, an economic assessment of the advisability of this process would be of interest under the present-day market conditions. Unfortunately, the problems of economy and competitiveness of Russian magnesium on the world market are not dealt with in the monograph.

In earlier monographs and textbooks, many important physicochemical laws related to metallurgy of magnesium were illustrated with much more convincing and clear curves than those in the book under discussion. This refers both to processes of carnallite dehydration and to physicochemical properties of the electrolyte and effect of various components on its most important properties. The quality of Figs. 14, 20, 38, 67, and 104 is poor and Fig. 64 is simply erroneous. In our opinion, many apparatus layouts are overladen with unimportant details, which only makes difficult their perception. For unknown reason, names of authors of investigations are mentioned, but no appropriate references are given. The polygraphic design of the book is very well done.

The monograph by V.I. Shchegolev and O.A. Lebedev is of indubitable interest for a wide audience of specialists in manufacture of magnesium and its alloys. The book will be of use for post-graduate students, masters, and undergraduates specialized in metallurgy of light metals or applied electrochemistry.

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By electrolyte flow, magnesium moves through electrolysis cells and accumulates in a separator cell from where it is extracted and transferred to the casting house for casting magnesium and magnesium alloys into ingots. Electrolysis cells current intensity is âˆ¼ 200â€“300 kA.Â The second variant of magnesium electrolysis production process is based on high dehydration of carnallite in fluidized bed dryers by HCl injection into chambers together with combustion gases, HCl is gained from fuel burning in chlorine gas magnesium electrolysis cells. Solid highly dehydrated carnallite is charged into cells connected into flow lines having centralized magnesium collection. The process has passed pilot-commercial tests and is ready for industrial realization. Grishchenko, R.V., Improvement of technology and intensification of the electrolytic production of magnesium, Extended Abstract of Candidate Dissertation, St. Petersburg: OAO â€œVAMIâ€, 2003. http://tekhnosfera.com/usovershenstvovanie-tehnologii-i-intensifikatsiya-elektroliticheskogo-proizvodstva-magniya.Â Shchegolev, V.I. and Lebedev, O.A., Elektroliticheskoe poluchenie magniya (Electrolytic Fabrication of Magnesium), Moscow: Ruda i Metally, 2002. 33. Strelets, Kh.L. and Desyatnikov, O.G., Density of molten salts of the isoconcentration join (10 wt % MgCl2) of the MgCl2â€“CaCl2â€“NaClâ€“KCl system, Tr. VAMI, 1957, no. 39, pp. 401â€“412. 34.