

Utilization of the High Concentration Seawater - Development of the Low Energy Fused Salt Electrolysis Magnesium Technique -

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Summary

Japan has been completely dependent on overseas suppliers (particularly Chinese suppliers) for its supply and recycling of magnesium since the only domestic smelting company withdrew from the magnesium business in 1994. To realize a stable supply of magnesium without depending on overseas suppliers and reduce the cost of electrolysis, it has become important to develop new smelting technologies (material technologies). Thus far, the research and development of magnesium-related technologies, including molding, plastic processing, thermal processing, and surface treatment, excluding smelting technologies (material technologies), has been intensively carried out in national projects (supported by the New Energy and Industrial Technology Development Organization, NEDO) and regional innovative projects. In the future, magnesium will become an essential material for use in key industries, such as the automobile, electric, and airplane industries. The research and development of magnesium as a cathode material used in next-generation secondary cells is also expected to progress. Moreover, the technological development of electrolytic methods and electrode materials that can contribute to energy saving is necessary because a huge amount of power is consumed by electrolytic extraction during the electrolysis and the fused salt electrolysis of chloride. In fused salt electrolysis, graphite is mainly used for electrodes and electrolytic cells, and the heating of such electrolytic cells and the low performance of graphite electrodes are responsible for the high power consumption. We clarified that the decomposition voltages for bromine and chlorine were suppressed using boron doped diamond (BDD) electrodes instead of graphite electrodes during the electrolysis of high-concentration seawater discharged from desalination plants. Because a lower decomposition voltage leads to a reduction in power consumption, boron doped diamond (BDD) electrodes are expected to be used for fused salt electrolysis and electrolysis. Under these circumstances, we have promoted the research and development of a technology for refining magnesium chloride, a component of magnesium electrolytic baths, and a technology for fabricating boron doped diamond (BDD) electrodes. In addition, we are intensively carrying out research on the electrochemical characteristics of a magnesium fused salt electrolysis system employing the developed boron doped diamond (BDD) electrode and its refining technology.