ELECTROLYSIS OF MOLTEN $CaCl_2$–CaO SALT FOR DIRECT REDUCTION PROCESS OF TITANIUM OXIDE

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Titanium is a lightweight, extremely strong, and a highly corrosion resistant metal, and the scope of its application has widened in recent years. Although the demand for titanium has been increasing in recent years, the productivity of the current titanium production process is still low, and the cost of titanium metal is high. To develop an effective process for titanium production, the direct reduction processes of titanium dioxide (TiO_2) are extensively investigated all over the world. In our laboratory, a new reduction process of titanium by utilizing an electronically mediated reaction (EMR)[1] and molten salt electrolysis (MSE) has been investigated. It was demonstrated that titanium powder with more than 99.5 mass% purity could be directly obtained from TiO_2 by the EMR[2]. Once an efficient process for the production of the calcium (Ca) alloy reductant is established, this method has the potential to be the next generation titanium production process. With this background, the basic experimental work to develop an effective process for reductant production by MSE is carried out in this study.

To evaluate the optimum conditions for production of Ca alloy reductant, electrochemical properties of $CaCl_2$–CaO molten salt were analyzed by current voltage (*i* –*E*) measurement during electrolysis and also by cyclic voltammetry (CV). Ca deposition on cathode and Cl_2 gas evolution on anode was observed during electrolysis of pure $CaCl_2$ molten salt at 1100 K. After CaO addition to the $CaCl_2$ molten salt, Ca deposition on cathode and CO or CO_2 gas evolution on the anode was observed. To evaluate current and energy efficiency of MSE for producing Ca alloy reductant, electrolysis of $CaCl_2$–CaO molten salt under various conditions is currently being investigated.

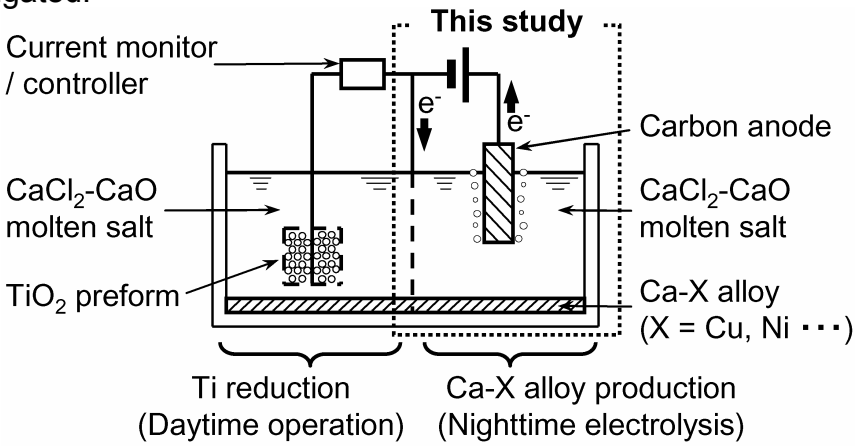

Fig. Schematic diagram of EMR/MSE process.

References:

[1] T. H. Okabe, I. Park, K.T Jacob, and Y. Waseda, *J. Alloys and Compounds*, 288, 200 (1999).

[2] T. Abiko, I. Park, and T. H. Okabe, *Proceedings of 10th World Conference on Titanium*, (2003).