Short Communication

Electrochemical Behavior of Fe-Ni Alloys as an Inert Anode for Aluminum Electrolysis

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Fe-Ni alloys have been regarded as promising candidates for inert anodes of aluminum electrolysis. In this study, a binary Fe–Ni alloy with 32 wt% Ni content was tested as an inert anode, and its high temperature oxidation and corrosion behavior were studied. Thermogravimetric oxidation showed that the oxidation kinetics followed the parabolic law, and the oxidation rate constant was $9.568 \times 10^{-4} \text{ kg}^2 \cdot \text{m}^{-4} \cdot \text{h}^{-1}$ at 970 °C. Fe_2O_3 and Fe-Ni-O were identified as two major components of the oxidation scale using a combination of X-ray diffraction and energy dispersive spectrometry. The anodic behavior of pre-oxidized and non-oxidized Fe–Ni alloys in cryolite-alumina melts was studied for the first time in a laboratory-scale transparent electrolysis cell. It was observed that small bubbles were released rapidly on pre-oxidized anodes, while no bubbles were generated on non-oxidized anodes and the molten electrolyte become opaque quickly. These findings confirmed that the precondition of the Fe-Ni alloy is helpful to improve its corrosion resistance.

Keywords: aluminum electrolysis; inert anode; Fe-Ni alloy; corrosion behavior; transparent electrolysis cells

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