Oxidation and Corrosion Behavior of (Cu-10Cu₂O) - (NiFe₂O₄-10NiO) Cermet Inert Anode with Interpenetrating Structure

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Cermet anodes with a composition of 26 wt % (Cu - 10 Cu₂O), 74 wt % (NiFe₂O₄ - 10 NiO), and interpenetrating structure were prepared via the pressureless infiltration. The air oxidation and electrolytic corrosion in cryolite molten salt of the cermets were studied concerning related microstructure evolution. Results showed that external diffusion oxidation of Cu was the main oxidation mechanism, which led to the formation of a porous zone between the oxidation and un-oxidation zone. The oxidation depth increased along with the higher oxidation temperature; an oxidation depth of 380 μm was confirmed when oxidized at 960 °C for 12 h. The corrosion resistance of the anodes with and without pre-oxidation treatment was similar. The influence of electrolyte on the corrosion was more important than that of the temperature. The corrosion became more serious as the decrease of electrolysis temperature from 960 °C to 800 °C, caused by the decreased current density. With the decrease of current density in the range of 0.2 A/cm² - 0.8 A/cm², a dense surface layer was more easily formed on the anode bottom. The corrosion of copper oxides was also related to the current density. As the decrease of current density, the corrosion of copper oxide became slower. The side and the bottom were hard to construct synchronously a dense surface layer owing to the uneven electrical distribution.

Keywords: Inert anode; aluminum electrolysis; interpenetrating structure; high temperature oxidation; molten corrosion

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