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Electrophysical and mechanical properties of SnO_2–Sb_2O_3–C ceramic-based composite material

ABSTRACT. Materials based on tin oxide and antimony oxide are of great interest as they are conductive at high temperatures and possess high corrosion resistance in corrosive environments such as the electrolytes used in aluminium electrolysis. Hence these tin dioxide-based materials can find wide application as current-carrying anodes in aluminium production. In this work the electrophysical and mechanical properties of SnO_2–Sb_2O_3–C ceramics have been studied. Materials have been synthesized by: preparing the mixture, pressing with polyvinyl alcohol, drying and firing at 1573 K. Specific electrical resistivity in the range 20–1000 °C was measured by a four-contact method. Thermophysical characteristics were obtained by a laser flash method. Material phase composition was determined by X-ray analysis, and microstructure by electron microscopy. It was demonstrated that the specific electrical resistance of 96%SnO_2–2%Sb_2O_3–2%MnO_2–2%C at 600–700 °C is practically temperature-independent. Above 700 °C the specific electrical resistivity of the material begins to increase catastrophically due to carbon oxidation. At temperatures 700–1200 °C the specific electrical resistivity becomes the same as that of a classical semiconductor and practically the same as that of carbon-free ceramics with composition 96%SnO_2–2%Sb_2O_3–2%MnO_2. The replacement of MnO_2 by Al_2O_3 allows enlarging the temperature range of the electrical resistivity stability up to 1200 °C.

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