Microstructure and Electrochemical Properties of Refractory Ta-Y₂O₃ and Ta-ZrO₂ Nanocomposites

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The refractory tantalum-ceramic oxide nanocomposites were made using mechanical alloying. The tantalum powder was synthesized together with Y₂O₃ or ZrO₂ powders in the concentration of 5, 10, 20 and 40 wt.%. The nanocomposite powders were hot-pressed using the pulse plasma sintering mode. To achieve good sample integrity, the hot pressing at the temperature of 1300-1500°C was done. The nanocomposites had a crystallite size below 100 nm. The corrosion resistance was measured using the potentiodynamic mode in the Ringer's electrolyte. The increase of oxide ceramic phase content leads to increased corrosion resistance. Best corrosion resistance is exhibited by the Ta-20Y₂O₃ and Ta-20ZrO₂ composites with the corrosion current density of up to 4 orders of magnitude lower than for pure nanocrystalline tantalum.

Keywords: Tantalum-ceramic oxide nanocomposites; mechanical alloying; corrosion resistance

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