

Features of Densification, Structure Formation and Properties of Ceramic and Cermets on the Base of Chromium Carbide and Titanium Nitride Prepared by Hot Pressing

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Abstract

The kinetics of densification during hot pressing of Cr_3C_2 -50 mass % TiN powders and their mixtures with 5 and 20% Ni-Cr under pressures 5 and 37.5 MPa at temperatures 1180–1800°C was investigated. It was shown that the densification of the mixtures of both types during hot pressing is described by a generalized equation of a three-dimensional viscous flow of a porous body and is determined by nonlinear creep for a Cr_3C_2 -50% TiN material and by a linear flow of hard particles of carbide and nitride components in the nichrome-base liquid cementing phase for Cr_3C_2 -TiN alloys with 5 and 20% of binder. The lattice constant of titanium nitride increases from 0.4255 nm for the initial TiN to 0.4424 nm for the mixture with Cr_3C_2 due to dissolution of carbon. The solubility of chromium in TiN is 5-6%. The optimal combination of the density (5.8-6,1 g/cm³), hardness (81-86 HRA), and bending strength (1020-1110 MPa) is provided by the hot pressing of the materials with the Ni-Cr binder at temperatures 1270-1370°C under a pressure of 10 MPa.