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MATHEMATICAL MODELING OF DEFORMATION AND FRACTURE OF ZIRCONIUM CARBIDE POROUS SAMPLES SUBJECTED TO UNIAXIAL COMPRESSION

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In this work, deformation and fracture processes of zirconium carbide porous ceramics are addressed both experimentally and numerically. Zirconium carbide is widely used as a part of metal-based composite materials. The material in question, being prepared by the sintering, possesses a residual porosity, which is generally undesirable. The main goal of this work is to determine a constitutive response of porous matrix calibrated against the experimental study. Based on the structural studies, the residual porosity makes somewhat 7-8%, which is rather high. Designed computer models of the Representative Volume Element take an explicit account of porosity with an assumption of spherical pores, which are distributed randomly within the computational domain. The numerical modelling of samples loading is carried out in the framework of three-dimensional finite difference continuum damage mechanics approach. Calibration of several model parameters is made using theoretical values reported in the literature. The results of modelling satisfactorily meet an available experimental data in terms of uniaxial compressive strength, slightly worse agreement is between elastic properties.

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