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Orientation-dependent nanoscratch resistance of zirconium diboride ceramic grains

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Abstract

The orientation dependence of scratch resistance of zirconium diboride (ZrB_2) grains was investigated during nanoscratch testing. The experimental material was produced by spark plasma sintering (SPS) and the crystal orientation of ZrB_2 grains was determined by electron backscatter diffraction (EBSD) technique. Scratches were prepared on a previously mapped surface area by an instrumented indentation machine using Berkovich tip with constant loads of 50, 100 and 150 mN along lengths of 200 microns. The generated surface topography was studied by scanning electron microscopy (SEM), confocal and atomic force microscopy (AFM). Microplasticity was observed in the form of slip-lines and microcracking along the scratch tracks. The analysis of experimental data revealed significant anisotropy in residual scratch depth with the lowest resistance corresponding to the tilt angle of around $\Phi=50^\circ-60^\circ$. Anisotropic crack

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