APPLICATION OF THE 3D-EBSD TECHNIQUE TO STRUCTURE INVESTIGATION OF CUBIC ZrO_2 CERAMICS

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Zirconium dioxide is a well known ceramic material that has found a wide range of applications in engineering, such as: sensors, thermal barrier coatings and in catalysis. The cubic phase is stabilized by an addition of few weight percent of Ittria. The manufacturing of dense ZrO_2 ceramics is a well controlled process that enables production of sinters with required grain size and narrow size distribution. By compromising grain size with investigated materials volume that is achievable within reasonable time, one can obtain satisfactory statistics for grain boundary characterization. To fully describe a grain boundary one needs 5 macroscopic parameters. Three of these parameters are misorientation angles across the boundary, and the additional two provide information about the orientation of the boundary plane. The 3D-EBSD is the only technique developed so far, which enables the acquisition of information about all five parameters. The obtained experimental data is used as an input information for reconstruction of the grain boundary structure within the material, which is carried out using a dedicated software. Additionally, the same experimental data is used to derive information about the morphology of pores within the material. Statistical information about sample microstructure, such as number of grains, average grain size and pore fraction was calculated basing on the experimental data. Three dimensional visualizations of the reconstructed grain boundary and pore networks were rendered. Investigation of ceramics is challenging because of experimental difficulties like charging, but it can reward us with better understanding of relations between materials microstructure and its properties.