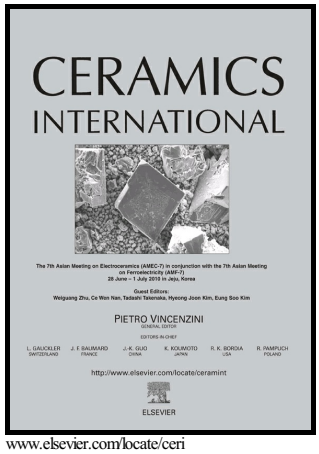

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THE ROLE OF CARBON NANOTUBES ON THE STABILITY OF TETRAGONAL ZIRCONIA POLYCRYSTALS

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ABSTRACT

The effect of single walled carbon nanotubes (SWNT) at zirconia grain boundaries on the stability of a tetragonal zirconia polycrystalline matrix has been explored in as–sintered composites and after low–temperature hydrothermal degradation (LTD) experiments. For this purpose, highly–dense 3 mol% Y_2O_3–doped tetragonal zirconia polycrystalline (3YTZP) ceramics and SWNT/3YTZP composites were prepared by spark plasma sintering (SPS). Quantitative X–ray diffraction analysis and microstructural observations point out that an increasing amount of well–dispersed SWNT bundles surrounding zirconia grains decreases the metastable tetragonal phase retention in the ceramic matrix after sintering. In contrast, the tetragonal ceramic grains in composites with SWNTs are less sensitive to the presence of water, i.e. to undergo a martensitic transformation under LTD conditions, than monolithic 3YTZP ceramics. The SWNT incorporation diminishes micro–cracking due to tetragonal to monoclinic ZrO_2 phase transformation in the composites.

Keywords: ZrO_2; Carbon nanotubes; Phase transformation; LTD