Combustion synthesis of Cr2O3-doped ?Al2O3 powders and dense ceramics

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Abstract

Combustion synthesis provides an attractive method for producing ceramic powders because of its low cost, simple processing and speed. Cr2O3-doped Al2O3 materials could be used for thermonuclear fusion reactors. The present work involved a straightforward combustion synthesis technique to prepare Cr2O3-doped Al2O3 powders (300, 1000, 10000 and 80000 ppm of dopant) using the corresponding metal nitrates-urea mixtures, at low temperature and short reaction times. To obtain high amounts of powder (industrial scalable process), to control the atmosphere used during the synthesis and to avoid losses due to possible projections during the combustion, a suitable reactor was designed. As is well known, Cr2O3-doped Al2O3 ceramic compacts do not densify well when sintered in air due to the vaporization and condensation process of Cr2O3 at high temperatures. For this reason, a hot-press technique was used for sintering the ceramic powders in order to minimize losses and obtain dense ceramics. As observed by SEM-EDX, dense and homogeneous microstructures were obtained. Furthermore, quantitative chemical analysis by ICP-AES confirmed that Cr2O3-doped -Al2O3 ceramics with a good compositional control were obtained.