Nanostructured Scandia Stabilized Zirconia Consolidated by High-Pressure Spark Plasma Sintering

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Scandia-stabilized zirconia, ScSZ, is an oxide-ion conductor with high ionic conductivity at relatively low temperatures (about 500 ºC). The consolidation of this ionic conductor requires high temperatures to achieve high densification, due to its low sinterability. Moreover, ScSZ exhibits a complex phase diagram for compounds up to 10 mol% scandia, including an ordered rhombohedral phase with low ionic conductivity. In this work, fully dense ScSZ specimens were obtained by high-pressure spark plasma sintering using deformable punches (DP-SPS). Nanocrystalline powders containing 6, 8 and 10 mol% scandia were synthesized by simultaneous precipitation followed by heat treatment at 500ºC for 2 h. The mean grain sizes of specimens consolidated by DP-SPS at 700 and 800ºC and at 1.5 and 2 GPa, varied from 8 to 17 nm. The grain size dependent cubic phase stabilization was evidenced by Raman spectroscopy. High degree of translucence was obtained in dense specimens of ScSZ obtained by the DP-SPS method.