

Enhanced mechanical performance of BaZr_{0.7}Ce_{0.2}Y_{0.1}O_{3-δ} (BZCY721) proton-conducting membranes prepared by cold sintering and subsequent thermal-treatment

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The conventional synthesis of barium zirconate cerate protonic membranes demands high sintering temperatures (~1600 °C) and lengthy dwell times (up to 24 h). This high-temperature processing results in Ba²⁺ loss, leading to impurity compounds and a reduction in overall conductivity. Therefore, a pre-cold sintering step was employed to densify BaZr_{0.7}Ce_{0.2}Y_{0.1}O_{3-δ} (BZCY721) ceramics at temperatures between 150 °C - 350 °C, followed by a subsequent thermal treatment at 1300 °C. The mechanical properties of the cold-sintered specimens were explored and compared with a sample sintered conventionally at 1600 °C. Similar densities were achieved regardless of sintering technique, although impurity phases, such as BaZr_{0.9}Y_{0.1}O_{2.68}, NiO, and Y₂O₃, were observed in cold-sintered specimens. Additionally, fine-grain size and low apparent porosity were observed in cold-sintered specimens, which translated to higher elastic modulus and hardness values. The Vickers indentation fracture toughness for 150 °C and 250 °C cold-sintered specimens was 1.26 MPa·m^{0.5}, in contrast to 0.93 MPa·m^{0.5} for the conventionally-sintered one. These differences in the fracture toughness were due to the porosity as shown via micropillar splitting, where all specimens exhibit the same values (~1.4 MPa·m^{0.5}). Finally, the total conductivity of the 150 °C cold-sintered specimen (1.48×10⁻⁴ S/cm) and the conventionally-sintered specimen (4.46×10⁻⁴ S/cm) were found to be similar at temperatures of 400 °C.

Professional Status of the Speaker

Doctoral or Master Student

Interest in submitting a paper in a special issue of

No interest

Invitation letter for visa

No

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