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Effect of sintering aids on the densification and electrical properties of SiO_2 – containing $Ce_{0.8}Sm_{0.2}O_{1.9}$ ceramic

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Abstract:

In this work, five different metal-oxide additives (metal=Ba, Co, Fe, Li, and Mn) were examined as sintering aids and SiO_2 impurity scavengers for $Ce_{0.8}Sm_{0.2}O_{1.9}$ (SDC). 2 mol% additives were loaded into the SDC with ~150 ppm (moderately impure) and ~2000 ppm (highly impure) SiO_2. Ba-, Co-, Fe- and Mn-oxides showed comparative sintering-aid effect on both moderately- and highly-impure SDC specimens, but the sintering-assisting effect of Li-oxide was completely neutralized in highly impure SDC. Regarding electrical property, the deleterious effect of 2000 ppm SiO_2 impurity on the grain-boundary conduction of SDC can be effectively alleviated by adding Ba-, Co-, Fe-, or Mn-oxides. Microstructure analysis revealed that Ba-oxide reacted directly with SiO_2 and consequently enhanced grain-boundary conduction. By contrast, with the addition of Co-, Fe-, and Mn-oxides, the improved grain-boundary conductions of impure SDC were related to the scavenging reactions between Si, Ca (another original impurity) and Sm components.