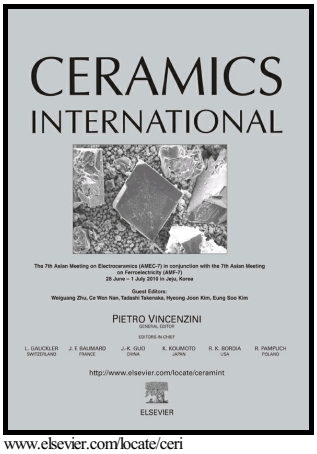

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High-temperature thermoelectric properties of Sm^{3+}-doped $Ca_3Co_4O_{9+\delta}$ fabricated by spark plasma sintering

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Abstract

$Ca_{3-x}Sm_xCo_4O_{9+\delta}$ ($0 \leq x \leq 0.3$) samples were fabricated by the sol-gel method followed by spark plasma sintering in vacuum. The high-temperature thermoelectric properties of the $Ca_{3-x}Sm_xCo_4O_{9+\delta}$ were also studied, with an emphasis placed on the partial substitution of Sm^{3+} for Ca^{2+}. The sintered $Ca_{3-x}Sm_xCo_4O_{9+\delta}$ formed a monoclinic $Ca_3Co_4O_9$ phase and exhibited fine lamellar grains and dense morphology. With increased Sm^{3+} content, the electrical and thermal conductivities decreased, whereas the Seebeck coefficient significantly increased. Of the prepared samples, $Ca_{2.7}Sm_{0.3}Co_4O_{9+\delta}$ had the largest dimensionless figure-of-merit (0.175) at 800 °C. The results showed that the partial substitution of Sm^{3+} for Ca^{2+} in $Ca_3Co_4O_{9+\delta}$ is effective for enhancing its thermoelectric properties.