Effects of La Content in Ceria-Lanthana Thin Films prepared by Pulsed Laser Deposition

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Solid oxide electrochemical reactors are a promising alternative for challenging chemical reactions, such as oxidative coupling of methane (OCM)[1], which convert methane to C^{2+}products. Cerium oxide is a commonly studied oxide membrane material for its high ionic conductivity in the temperature range ideal for conversion reactions (600-900°C), particularly when doped with rare earth cations like Gd, Sm, or La. Recent studies have shown $La_2Ce_2O_7$as a promising OCM catalyst[2]. This study investigates the structural properties of $La_xCe_{(1-x)}O_{2(1-x/2)}$thin films, prepared using pulsed laser deposition, with varying stoichiometry. XRD results indicate textured film growth with preferential [100] orientation of cubic crystalline fluorite for low La content ($x \leq 0.5$), while $x>0.5$ had a random orientation. La doping expanded the fluorite structure, increasing lattice parameters from 5.42 Å for x=0 to 5.69 Å for x=0.7. UV-Raman spectroscopy showed that La content x=10 caused a more pronounced balance between $Ce^{4+}$and Ce^{3+}than pure ceria samples. Impedance revealed a direct relationship between La content and resistance, indicating lower resistance with lower La content. These findings could lead to using Ce-La oxides thinfilms as catalysts for OCM in electrochemical reactors based on ceria.

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