SYNTHESIS AND CHARACTERIZATION OF ALKALINE EARTH METALS SUBSTITUTED LANTHANUM MOLYBDATE

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In recent decades, solid oxide fuel cells (SOFCs) have garnered attention for their clean and efficient energy production. Currently, one of the most widely used electrolytes is yttria-stabilized zirconia, but its excellent ionic conductivity is only noticeable at high temperatures (1000 °C), thereby limiting its practical use [1].

One of the most promising electrolytes operating at low temperatures is $La_2Mo_2O_9$ (LAMOX). This compound crystallizes into two different crystallographic modifications: the low-temperature monoclinic α-phase and the high-temperature cubic β-phase. Above 580 °C, a phase transition to the β-phase occurs, significantly enhancing oxygen-ion conductivity by almost two orders of magnitude. To stabilize the high-temperature phase at room temperature, various ions can be used to dope lanthanum and molybdenum sites. Substituting alkaline earth metals into lanthanum sites not only suppresses the phase transition but also increases the concentration of oxygen vacancies, leading to higher ionic conductivity [2].

This study is focused on the synthesis of $La_{2-x}M_xMo_2O_{9-x/2}$ (M=Ca^{2+}, Sr^{2+}, Ba^{2+}; x=0.01–0.2) ceramic using a tartaric acid-assisted aqueous sol-gel synthesis technique. X-ray diffraction analysis was used to identify the crystal structure and detect impurity phases of the heat-treated ceramics. It was estimated that by the increase in the alkaline earth metal radius, the substitution limit of the corresponding element in the LAMOX system also increases. Moreover, DSC analysis revealed that with the increase of the substitution degree in the multicomponent oxide, the intensity of the phase transition tends to decrease. However, after further substitution by alkaline earth metal in the final ceramic material, the intensity of the phase transition starts to increase again due to the formation of impurity phases in the as-formed crystalline mixture.

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