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IMPACT OF ACCEPTOR-TYPE SUBSTITUTION ON ELECTRICAL TRANSPORT PROPERTIES OF ZIRCON-TYPE $EuVO_4$

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Abstract

Magnesium-substituted europium vanadate ceramics, $Mg_xEuVO_{4\pm\delta}$ (x = 0-0.5), were prepared by solid state method and characterized by XRD, SEM/EDS, dilatometry, UV-visible spectroscopy, impedance spectroscopy, and measurements of oxygen-ion transference numbers ($\overline{t_O}$). Magnesium was found to substitute preferentially into vanadium sublattice of zircon-type $EuVO_4$ with limited solubility of ~5 at.%. Additions of magnesium increase slightly coefficients of thermal expansion (3.2-6.0 ppm/K at 150-400°C) and have negligible effect on the optical properties. Undoped $EuVO_4$ is predominantly an oxygen-ionic conductor with $\overline{t_O}$ = 0.96-0.99 at 700-900°C under oxidizing conditions. Acceptor-type substitution suppresses total conductivity and oxygen-ionic transport. The variations of electrical transport properties are discussed in terms of interstitial oxygen diffusion in the parent $EuVO_4$ and oxygen vacancy diffusion in Mg-substituted vanadate. Humidified atmosphere has negligible impact on the electrical properties of substituted ceramics but results in