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Ruddlesden–Popper type $La_{1.5-x}Eu_xPr_{0.5}Ni_{0.9}Cu_{0.1}O_{4+\delta}$ as a Potential Cathode Material for H-SOFCs

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Received: December 11, 2020
Revised: December 29, 2020
Accepted: January 16, 2021

As a potential cathode material, the $La_{1.5-x}Eu_xPr_{0.5}Ni_{0.9}Cu_{0.1}O_{4+\delta}$ (LEPNC-x, $x = 0$, 0.1, 0.2, 0.3, 0.4, 0.6, and 0.8) oxide is synthesized and studied. A pure Ruddlesden–Popper (R−P) type K_2NiF_4 structure can only be obtained for $x = 0.4$ and lower. The thermal expansion coefficient (TEC) of Eu-doped LEPNC-x stays almost constant with temperature, and decreases with increasing x. The optimal electrochemical performance of NiO-BZCY|BZCY|LEPNC-x single cells can be achieved for $x = 0.2$, although the corresponding electrical conductivity is the lowest. The result ofelectrochemical impedance spectra (EIS) also confirms this conclusion. EIS analysis suggests that the pre-exponential factor and activation energy of polarization resistance should be mainly determined by the electrical conductivity and oxygen ion diffusion of cathode material, respectively.

Keywords: K_2NiF_4 cathode, Eu doping, electrical conductivity, thermal expansion coefficient, H-SOFC.