Oxygen evolution electrocatalytic properties of perovskite-type oxides obtained by PVP sol-gel route: Part II. The effect of partial substitution of Sm for Sr in $\text{La}_{0.4}\text{Sr}_{0.6}\text{CoO}_3$

Narendra Kumar Singh*, Priya Sharma, Manish Kumar Yadav and Reena Parihar

Department of Chemistry, Faculty of Science, University of Lucknow, Lucknow-226007, India

*E-mail: nksbhu@yahoo.com, singh_narendra@lkouniv.ac.in

doi: 10.20964/2020.07.81

Received: 9 March 2020 / Accepted: 2 May 2020 / Published: 10 June 2020

This paper deals the findings of quaternary perovskite-type oxides, $\text{La}_{0.4}\text{Sm}_x\text{Sr}_{0.6-x}\text{CoO}_3$ ($0 \leq x \leq 0.4$), which is the extended research work obtained by further substitution Sm (0.2 to 0.4 mol) for Sr in the ternary perovskite oxide of $\text{La}_{0.4}\text{Sr}_{0.6}\text{CoO}_3$ prepared by PVP sol-gel route. The cyclic voltammogram (CV) showed similar redox peaks; one anodic an anodic ($E_{pa} = 489 \pm 20$ mV) and corresponding cathodic ($E_{pc} = 355 \pm 25$ mV) with each oxide electrode in the potential region 0.0-0.7 V. The anodic polarization study in 1 M KOH at 25 °C indicates that the substitution of Sm (0.2 and 0.3 mol) increased the electrocatalytic property of the material. However, a reduction in electrocatalytic activity is observed with 0.4 mol Sm-substitution. At potential $E = 800$ mV, $\text{La}_{0.4}\text{Sm}_{0.2}\text{Sr}_{0.4}\text{CoO}_3$ ($j = 191.9 \text{ mAcm}^{-2}$) showed about 5 times higher electrocatalytic activity than base oxide; $\text{La}_{0.4}\text{Sr}_{0.6}\text{CoO}_3$ ($j = 37.6 \text{ mAcm}^{-2}$). A reduction in Tafel slope has also been observed upto 0.3 mol Sm-substitution. Similar trend was also found in the case of thermodynamic study, such as standard entropy of activation ($\Delta S^\ddagger$), standard enthalpy of activation ($\Delta H^\ddagger$) and standard electrochemical energy of activation ($\Delta H_{el}^\ddagger$) of the materials. Some physicochemical techniques like X-ray diffraction (XRD) and scanning electron microscope (SEM) have been used to analyze the synthesized products.

Keywords: Quaternary perovskite-type oxides, PVP method, XRD, Electrocatalytic activity, Thermodynamic parameters

[FULL TEXT](#)

© 2020 The Authors. Published by ESG (www.electrochemsci.org). This article is an open access article distributed under the terms and conditions of the Creative Commons Attribution license (<http://creativecommons.org/licenses/by/4.0/>).