Synthesis and Electrocatalytic Properties of $\text{La}_{1-x}\text{Sr}_x\text{CoO}_3$ ($0 \leq x \leq 0.8$) Film Electrodes for Oxygen Evolution in Alkaline Solutions

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Perovskite-type oxides of lanthanum and cobalt with composition $\text{La}_{1-x}\text{Sr}_x\text{CoO}_3$ ($x = 0.0, 0.2, 0.4, 0.6$ and 0.8) have been prepared by a low temperature sol-gel route. Electrodes of the material were formed on pretreated Ni-support by oxide slurry painting technique and studied their electrochemical behavior with regards to oxygen evolution reaction (OER) in aqueous KOH solution. The electrochemical characterization was done in three electrode single compartment glass cell using Gamry (Reference 600) Electrochemical Work Station. Techniques used for electrochemical studies were cyclic voltammetry and Tafel polarization. The data showed that the substitution of Sr ($0.2 - 0.8$ mol) increased the electrocatalytic activity of the oxide. The value was found to be highest with 0.8 mol Sr. The Tafel slopes and reaction order with respect to OH^- concentration for oxygen evolution reaction were found to be $65-77 \text{ mVdecade}^{-1}$ and unity, respectively. The cyclic voltammogram recorded between $0.0 - 0.7 \text{ V}$ in 1 M KOH at 25°C exhibited a pair of redox peaks prior to oxygen evolution reaction. The thermodynamic parameters for oxygen evolution reaction such as, standard electrochemical enthalpy of activation ($\Delta H_{\text{e}}^{0\#}$), standard enthalpy of activation ($\Delta H^{0\#}$), and standard entropy of activation ($\Delta S^{0\#}$) have also been calculated by recording the Tafel polarization curve in 1 M KOH at different temperatures. Oxide samples were characterized physicochemically by scanning electron microscope (SEM) powder X-ray diffraction (XRD) techniques.

Keywords: Perovskite-type oxide, sol-gel, XRD, Electrocatalysis, Thermodynamic parameters

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