Chapter – 2

OBJECTIVE

Spinel ferrites of Co-, Ni- and Mn- and lanthanum based perovskite-type oxides of Ni-, Co- and Mn- are considered as potent electrocatalytic materials for the oxygen evolution (as anodes in water electrolysis cells), reduction reaction (as cathodes in fuel cells and metal air batteries). These materials are widely used as heterogeneous catalysts in catalytic converters (in automobiles) for oxidation of CO, unburnt hydrocarbons etc.

Literature of the investigation shows that the oxide catalysts obtained by conventional ceramic and thermal decomposition method, which usually require high temperatures, produce materials with low specific surface area and contain some impurities also. The interfacial properties as well as electrocatalytic properties of these materials are strongly influenced by preparation variables such as experimental conditions such as, concentration of the starting substances, pH of the solution, temperature, methodology and nature of the starting substances used. Recently, a number of low temperature methods such as co-precipitation, sol-gel (by the used of organic acids), sequential solution coatings, spray pyrolysis, freeze-drying electrodeposition etc have been reported and used in synthesis of electrocatalyst for electrocatalysis of oxygen evolution/reduction. These methods produce oxides with high specific surface area and more homogeneity. The main objective of title investigation is to synthesize the materials with high specific surface area as well as enhanced electrocatalytic properties with regard to oxygen evolution reaction in alkaline medium. Results of these low temperature synthesized materials were found to be improved significantly for electrolysis point of view.

In view of these, we adopted low temperature synthetic routes namely, citric acid, malic acid, egg-white sol-gel and NaOH co-precipitation methods for the synthesis of spinel ferrites $M_xFe_{3-x}O_4$ (M = Ni, Co and $0 \leq x \leq 1.5$) and perovskite-type oxides $La_{1-x}M'_xCoO_3$ (M′ = Sr, Cu and $0 \leq x \leq 0.8$) with the aim to improve their physicochemical as well as the electrocatalytic properties towards oxygen evolution reaction (OER) in alkaline solutions. In physicochemical characterization techniques used were infrared spectroscopy,

X-ray diffractometer and scanning electron microscope. Cyclic voltammetry (CV) and Tafel polarization techniques were taken to study the electrochemical measurements. Details of experimental findings are presented in ‘Results and Discussion’ section.