

PREFACE

At present, fossil fuels, such as, petroleum, coal, natural gas etc are the main sources of energy worldwide. These energy resources are non-renewable and cause pollution to the environment. Investigations are going on globally to produce renewable and non-pollutant energy devices. Presently, resources like solar, wind and hydrogen are considered as alternatives to the conventional energy sources. Hydrogen production by water electrolysis is a clean and simple way of storing energy and can subsequently be utilized in fuel cells without concern of contaminants such as carbon monoxide, CO₂ etc. It is therefore, desired to improve the performance and efficiency of water electrolysis cell by using suitable and effective electrocatalysts. Therefore, suitable electrode materials are required to reduce both cathode and anode overpotentials. Among the investigated electrocatalytic materials, transition metal mixed oxides of spinel (mainly Co- and Fe- based) and perovskite (mainly Ni-, Co-, Fe- and Mn- based) families have been proved to be an interesting and very promising electrode materials for alkaline water electrolysis. It is reported that the catalytic properties of these materials is strongly influenced by preparation method and suitable metal ion substitutions. In the present investigation, some spinel and perovskite-type transition metal mixed oxides have been synthesized by sol-gel and co-precipitation method and studied their physicochemical and electrocatalytic properties towards the oxygen evolution reaction in alkaline solutions.

In the present study, spinel ferrites, M_xFe_{3-x}O₄ (M = Ni, Co and 0 ≤ x ≤ 1.5) using egg-white sol-gel and co-precipitation method and perovskite-type oxides, La_{1-x}M'_xCoO₃ (M' = Sr, Cu and 0 ≤ x ≤ 0.8) using malic and/ or citric acid sol-gel route have been synthesized and studied their electrocatalytic properties towards oxygen evolution in alkaline solutions. The present thesis comprises of details of the study performed and the results obtained. The whole thesis is divided into five

main chapters: Introduction, Objective, Experimental, Results and Discussion and Summary. A brief overview of each chapter is given below:

Chapter 1 (**Introduction**) deals with the importance of electrolytic production of hydrogen by water electrolysis; thermodynamic and kinetic aspects of water electrolysis; earlier work carried out for oxygen evolution reaction on spinel and perovskite-type oxides.

Chapter 2 (**Objective**) highlights the aims and prospective of the present research work.

Chapter 3 (**Experimental**) deals with the details of chemical used in preparation and characterization of transition metal mixed oxide electrocatalysts, methodology and instruments employed in the study.

Chapter 4 (**Results and Discussion**) deals with the experimental findings and their comparison with the literature values.

Chapter 5 (Summary); the important finding and conclusions of the whole study are given in this chapter.

A list of the references quoted from the literature, books consulted, symbols and abbreviations used, photocopies of the paper published/ accepted/ submitted/ a list of papers presented in the conferences/ seminars/ symposium are also given at the end.