CHAPTER 1 INTRODUCTION

In this thesis, we study the preparation of CeO_2 nanoparticles by emulsion method and their reforming reactivity. This chapter gives a short description of the cerium oxide, widely utilized representative of rare earth material. The introduction ends with an outline of the other chapters and appendices.

The rare earth composites were praise treasury of materials due to their special optical, electric and magnetic properties that were given by the specific "f" electron of rare earth element [1]. Studies on rare earth materials attracted an extensive interest with the development of new technologies. Various rare earth materials possessing different physicochemical properties have been produced due to the demand of different applications. For example, a powder having different particle size, density, specific surface area and morphology can be used in different industry areas.

As one kind of important rare earth materials, cerium oxide (CeO_2) powder has attracted considerable attention for its potential application as fast ion conductor, oxygen storage capacitors, catalyst, polishing, UV blockers, luminescence and solid electrolyte materials. However, its performance in different application areas is directly determined by its physicochemical properties. For example, superfine CeO_2 can decrease the calcinations temperature and increase the density of ceramic, various particle size of CeO_2 can meet the different demands of polishing, in general, the polishing of semiconductor will need CeO_2 powder with a fine particle size [2], in catalyst area using CeO_2 with a higher specific surface area as carrier can enhance catalytic activity of catalyst.

The aims of this work are to prepare and characterize nano-sized CeO_2 for catalysis application under different experimental conditions and to evaluate efficiency of the CeO_2 by using as catalyst in reforming process. **Chapter 2** reviews the available literatures and provides background information on the synthesized CeO_2 nanoparticles. In **Chapter 3**, the theory involving general properties of CeO_2 and its applications, structure of colloidal emulsion aphrons and how to prepare nanoparticles with CEAs.

In order to accomplish the goals of this study, the experimental works were performed and analyzed categorizing as two main parts. In the first part, preparation and characterization of nano-sized CeO_2 by different microemulsion methods and selected the suitable method to study the factors that effect on the CeO_2 particles were demonstrated in **Chapter 4**. In the second part, **Chapter 5**, the goal of this chapter is to use CeO_2 as a catalyst support material in methane steam reforming. Therefore, the studied for improved CeO_2 for high thermal stability and reforming reactivity are discussed in this chapter. Characterization of the prepared sample was performed using various analytical techniques such as X-ray diffraction (XRD), transmission electron microscope (TEM) and temperature programmed reduction (TPR). **Chapter 6** summarizes the key findings for this work and offers some recommendations for future research.

In the appendix, some additional material can be found: **Appendix A** on the particle size distribution evaluated from transmission electron microscope (TEM) micrograph.