THE STUDY OF PREPARATION OF NANO-SIZED CeO_2 BY MICROEMULSION METHOD

INTRODUCTION

Nanometer-sized particles have attracted great interest in recent years because of their unique properties in physics and chemistry as well as their potential applications in industry . Various types of nanoparticles can be synthesized by many methods such as gas evaporation, laser vaporization, ionized beam deposition, sol–gel processing, freeze drying, etc. However, their properties were greatly affected by the synthesis methods. Compared with other techniques, microemulsions technique is one of the most recognized methods due to its several advantages, for instance, soft chemistry, demanding no extreme pressure or temperature control, easy to handle and requiring no special or expensive equipment. In general, microemulsion or ME is an isotropic, thermodynamically stable dispersion of oil, water, surfactant and often cosurfactant, which is normally alcohol. Microemulsion can be characterized as oil-in-water (O/W), water-in-oil (W/O) or bicontinuous system. Oil-in-water (O/W) is microemulsion containing exess oil phase with surfactant molecules existing in the aqueous phase in form of normal micelles. On the other hand, water-in-oil (W/O) microemulsion is the coexistence of an excess water phase and the surfactant molecules which aggregate in the oil phase in the form of the reverse micelle. It is well known that these micelles could perform as nano-scale reactors.

Rare earth compounds have wide applications because of their special electronic configuration. However, nanostructural rare earth compounds, because of the high surface-to-volume ratio and quantum-size effect, present unusual chemical and physical properties different from those bulk materials. The potential properties and applications of nanometer-scaled cerium compounds prompt a wide research from synthesis, structures and properties to applications. Recently, there has been a great scientific interest in the synthesis of cerium oxide nanoparticles and the modifications of their size, morphology and property for a large variety of applications such as

ultraviolet absorbent, glass polishing materials and three-way catalysts for the automotive industry.

In this thesis, nano-sized CeO_2 were prepared by microemulsion method. The technique of preparation, the effect of the type of cerium source and the effect of the sort of surfactant were investigated.

Objectives of research

1. To study the preparation of nano-sized CeO_2 by microemulsion method.
2. To study factors that affect the preparing condition
   2.1 Effect of the type of cerium source.
   2.2 Effect of the sort of surfactant.

Scopes of research

1. To study the technique of preparation of nano-sized CeO_2 by microemulsion method, combine homogeneous precipitation method and microemulsion method and mixing of two microemulsions.

2. To study the effect of types of cerium source on the particle size of CeO_2 prepared from microemulsion method.

   2.1 Cerium nitrate hexahydrate ($Ce(NO_3)_3 \cdot 6H_2O$)

   2.2 Ammonium cerium nitrate ($(NH_4)_2Ce(NO_3)_6$)

   2.3 Cerium chloride heptahydrate ($CeCl_3 \cdot 7H_2O$)

3. To study the effect of sorts of surfactant on the particle size of CeO_2 prepared from microemulsion method.

   3.1 Polyoxyethylene-4-lauryl ether (PE4LE)

   3.2 Polyoxy ethylene-10-oleyl ether (Brij96V)

   3.3 Cetyl trimethyl ammonium bromine (CTAB)