

Preparation of spherical Fe and Au nanoparticle in water in oil microemulsion

Yong-jin Kim^{*1}, Ji-hun Yu¹, and Jung-Ho Ahn², Youl-Zhoo Sung²

¹Materials Technology Department, Korea Institute of Machinery and Materials, Korea

²Department of Materials Engineering, Andong National University, Korea

Introduction

Many techniques have been developed for fabrication of the novel metal nanoparticles such as CVC process, polyol process and sonochemical method. In these techniques, microemulsion process is the one of useful process to make nanoparticles because the process can effectively control the particle size, shape and its distribution by controlling water droplets in oil phase. In this study, we develop a microemulsion process for fabrication of iron-gold nanopowder having spherical and uniform particle size. The study includes design of microemulsion system, chemical reaction between salt and reducing agent, and powder characterization.

Experimental Procedure

The reverse micelles systems used in this study were consisted of CTAB+1-butanol/octane/aqueous solution. CTAB (cetyltrimethylammonium bromide, $C_{19}H_{42}BrN$) is used as the surfactant, 1-butanol as the cosurfactant, octane as the matrix phase, aqueous solution as the water droplets. At first two different reverse micelles consisting of an iron salt and reduction agents were then mixed. Reduction reactions occurred only inside aqueous nanodroplets resulting in the formation of metallic nanopowders. And then two different aqueous solutions consisting of gold salt and reduction agents were put into reverse micelles and were mixed. Reverse micelles swelled and reduction reaction of gold salt occurred in the reverse micelles. The particles obtained using the reverse micelle method were characterized using TEM, XRD and VSM.

Results and Discussion

Fe-Au nanopowders were successfully synthesized by reverse micelle method: mixing of reverse micelles consisting of aqueous nanodroplet and octane matrix together with CTAB. The synthesized particles have spherical shape and uniform size distribution (3~8nm) in XRD result, metallic Fe and Au crystalline phases were observed without oxides or intermediate phase and the synthesized particles have very low coercivity exhibiting superparamagnetism.