

화학적환원법에 의한 나노크기의 은분말 합성 (Synthesis of nanosized silver powder by chemical reduction method)

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1. Introduction

Silver powders having ultrafine and uniformly distributed sizes are of considerable current use in electronics, chemical industry, medicine due to unique properties such as high electrical and thermal conductivity, high resistance to oxidation, bactericidal action(colloid silver)etc. In this regard, nanosized powders and colloidal dispersion of silver have attracted a great deal of attention in recent years. Many methods, such as chemical reduction, photochemical or radiation-chemical reduction, metallic wire explosion, sonochemical method and polyol method are being applied currently to prepare ultrafine silver powders. From a practical point of view, the method of chemical reduction from aqueous solution is most preferable for obtaining nanosized powders and colloidal dispersion of silver. In the present study, we have developed a new and effective way for preparation of nanosized powder and colloidal dispersion of silver through the colloidal dispersion of Ag_2O as intermediate precursor.

2. Experimental and results

Nanosized uniform silver powders and colloidal dispersions of silver were prepared from $AgNO_3$ by a chemical reduction method involving the intermediate preparation of Ag_2O colloidal dispersion in the presence of sodium dodecyle sulfate $CH_3(CH_2)_{11}OSO_3Na$ as a surfactant. The crystal structure of silver powders was analyzed by X-ray diffractometer(XRD) with Cu_K radiation. The study of microstructure was carried out using Scanning Electron Microscope(SEM) equipped with Energy Dispersive X-ray Spectroscopy(EDS) or Field Emission Scanning Electron Microscopy(FESEM) for the observation of submicron structure. The distribution of particle size in the colloid solution was detected by Laser Particle Size Analyzer-BIC(LPSA). Several reducing agents such as hydrazine hydrate ($N_2H_4 \cdot H_2O$), formaldehyde (HCOH) and glucose ($C_6H_{10}O_5$) have been found to be preferable in this study from a practical point of view. The formation of intermediate colloidal dispersion of Ag_2O by application of sodium dodecyle sulfate allowed synthesis of nanosized silver powder and a colloidal dispersion of silver. The silver powder with the 60-120nm particle size and colloidal dispersion with the particles size 10-20nm and 0.5-2.0wt% concentration were successfully synthesized.