Dissertation Title	Preparation and Characterization of Alumina Nanoparticles in Deionized Water using Laser Ablation Technique
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Abstract

Alumina nanoparticles were synthesized using laser ablation of an aluminum (Al) target in deionized water. Nd:YAG laser, emitted light at a wavelength of 1064 nm, was used as a light source. The laser ablation was carried out at different voltages of 300, 400 and 500 V with each voltage having energies of 1, 3 and 5 J. The morphology of the nanoparticles was investigated by field emission scanning electron microscopy (FE-SEM). The FE-SEM images showed that most of nanoparticles obtained from all voltages have spherical shape with a particle size of less than 150 nm. Furthermore, it was observed that the particle size increased with increasing laser energy. The absorption spectra of the alumina nanoparticles suspended in the deionized water were recorded at room temperature using UV-visible spectroscopy. The absorption spectra showed a strong peak at 210 nm which arose from the presence of the alumina nanoparticles. The structure of the ablated Al particles suspended in the deionized water was investigated using X-ray diffraction (XRD). The XRD patterns revealed that the ablated Al particles transformed into γ-Al_2O_3. The XRD results are in good agreement with those of absorption spectra which confirm the formation of Al_2O_3 nanoparticles during the laser ablation of Al target in deionized water. The chemical composition of nanoparticle was carried out using energy dispersive spectroscopy (EDS). The ratio of aluminum to oxygen was approximately 2:3, supporting the information of stoichiometric Al_2O_3. The binding energy of the alumina nanoparticles was analyzed using X-ray photoelectron spectroscopy (XPS). The XPS results correspond to the binding energy of Al_2O_3. In addition, the simple RLC simulation model to estimate the laser output power was also carried out. The obtained power was then used to simulate the temperature of Al pellet surface using heat conduction equation.

Keywords: γ-Al_2O_3/ Alumina Nanoparticle/ Laser Ablation/ Nd:YAG Laser