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Using laser-induced jets fabrication method to control the particle size and alloy ratio of nanoparticle arrays

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In this study, we developed a new method—based on laser-induced jets of nanoparticles (NPs) and air drag forces—to select the particle size and control alloy ratio of NP arrays. First, thin metal (Au, Ag) films having a thickness of 35 nm were deposited on fused silica substrates through a sputter system. In addition, we can control the metal thin film ratio (Au/Ag, Ag/Au/Al) to manufacture variety alloy NPs. The pulsed laser light (Excimer laser) was irradiated on the rear side of the metal film-deposited fused silica substrates to generate jets of NPs. The incident wavelength of an excimer laser was varied to ensure good photo-to-thermal energy conversion efficiency. We then exploited air drag forces to select NPs with sizes ranging from 5 to 50 nm at different captured distances. Controlling the jet distances allowed us to finely tune the localized surface plasmon resonance (LSPR) wavelength. We further calculated the relationship between the air drag force and the diameter of the NPs to provide good control over the mean NP size (capture size >300 μm) by varying the capture distance. Laser-induced jets of NPs could also be used to fabricate NP arrays on a variety of substrates, including Si, glass, plastic, and paper. This method has the attractive features of rapid, large-area preparation in an ambient environment, no need for further thermal annealing treatment, ready control over mean particle size, and high selectivity in the positioning of NP arrays. Detailed analysis and results will be reported in the conference.

Biography

Shao-Chin Tseng has completed his PhD from Department of Materials Science and Engineering, National Taiwan University. He is the Assistant Scientist of National Synchrotron Radiation Research Center. He focuses on Nanotechnology, X-ray nanoprobe, Optoelectronic Materials, Semiconductor Process, Biomedical Sensing. He has published more than 25 papers in reputed journals.

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