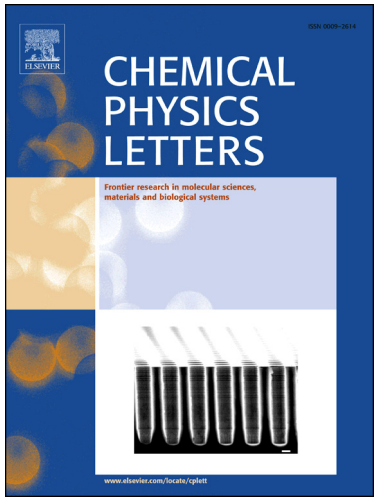

Gap mode induced laser trapping of silver nanoparticles on thiophenol-covered silver substrates

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Gap mode induced laser trapping of silver nanoparticles on thiophenol-covered silver substrates

Chiaki Iida, Keitaro Akai, Junichi Murakami, Masayuki Futamata[1]
Graduate School of Science and Engineering, Saitama University, Saitama 305-8562, Japan

Abstract

Silver nanoparticles (AgNPs) with radius of ~20 nm were optically trapped and immobilized on thiophenol (TP)-covered Ag films under a gap mode resonance with extremely weak power density of ~1 $\mu W/\mu m^2$ at 532 nm. Intensity of Raman scattering from TP markedly increased with the accumulation of AgNPs. Trapping efficiency of AgNPs for p-polarization was 2-4 times higher than that for s-polarization. The observed optical trapping and immobilization were theoretically rationalized using a dipole-dipole coupling under a gap mode and van der Waals interaction between AgNPs and Ag films, which facilitate to fabricate versatile substrates for surface enhanced Raman scattering.

Keywords

optical trapping, gap mode, surface plasmon, surface enhanced Raman scattering, dipole-dipole coupling, DLVO theory

1. Introduction

Since the pioneer work by Ashkin [1], dielectric particles, molecules and atoms have been optically trapped and manipulated at a beam waist of tightly focused laser using gradient force and radiation pressure [2-11, 28]. Trapping of particles with sizes larger than wavelength of incident laser is characterized by geometrical optics and momentum conversion, whereas optical response via polarization is employed to evaluate the trapping of

[1] To whom correspondence should be addressed. E-mail: futamata@chem.saitama-u.ac.jp