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Infrared absorption enhancement phenomenon on nano materials

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The intensification of infrared-active vibrational modes of molecules in close proximity to nanometer-thick metal films, commonly known as surface-enhanced infrared absorption (SEIRA), is receiving increased attention from both a phenomenological and practical viewpoint. The resonant excitation of plasmon in metallic nanostructures can provide large field enhancements on the surfaces of metals, which in turn provide dramatic increases in the detected spectroscopic signals for molecules adsorbed on their surfaces. The most widely used surface enhanced spectroscopy (SES) is surface enhanced Raman scattering (SERS), where the electromagnetic enhancement factor is proportional to the fourth power of the field incident on the molecule. Recently there has been a resurgence of interest in another type of SES, surface enhanced infrared absorption. It has been widely applied to surface trace analysis, bio-sensing, electro sorption, and electro catalysis because of its significant amplification of surface signal and simple surface selection rule. The surface enhanced infrared absorption can be observed easily on metal island films prepared by vacuum evaporation or sputtering and electrochemical or electroless deposition. Metal colloids also support the enhancement. Like surface-enhanced Raman scattering (SERS), SEIRA is chiefly of electromagnetic origin, that is, due to an increase in the local optical field exciting the adjacent molecule. Metal nano clusters much smaller than the wavelength of light facilitate the interaction of the infrared radiation with the metal and adsorbed molecules, resulting in the enhancement. It was explained that the enhancement is greatly affected by the size, and planer density of metal nano clusters compared with metal nano films. Phenomenological and theoretical difference of infrared absorption in broad ranges of wave length including near field to far field infrared rays between metal nano clusters and metal nano films. Especially, metal nano clusters exhibit much higher infrared absorption than metal nano films on broad ranges of wave length. The phenomenon of infrared absorption in the range of near infrared wave length was different from that of far infrared wave length. This different phenomenon involves shift of resonant peaks and absorption intensities on them. Also the planar density of the metal nano clusters suggests a mechanism to explain the phenomenon.

Biography

Jae Hong Park has completed his Ph.D. at the age of 33 years from Seoul National University and postdoctoral studies from Korea Institute of Science and Technology and Harvard Medical School, respectively. He is a senior researcher of National NanoFab Center in Korea. He has published more than 30 papers in reputed SCI journals and serving as an editorial board member of repute.

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Preparation of bi-functionalized silver nanoparticles and their colorimetric application for selective and sensitive detection of Mn^{2+}

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A facile, selective and highly sensitive method is proposed for colorimetric detection of manganese ions using thioglycolic acid (TGA) and guanidine hydrochloride (G.Hcl) modified silver nanoparticles (AgNPs). The presence of Mn^{2+} induces the aggregation of AgNPs through cooperative metal-ligand interaction, resulting in color change from pale yellow to pink .The cofunctionalized AgNPs showed obvious advantages over the ones functionalized only by TGA or G.Hcl in terms of selectivity. Mn^{2+} could be monitored by colorimetric response of AgNPs by a UV-vis spectrophotometer or even naked eyes. The absorbance ratio (A426 nm/A395 nm) is linear with a correlation coefficient of 0.989, and the detection limit is as 0.034 πM. Particularly, this cost-effective process also allowed rapid and simple determination of the Mn^{2+} in drinking water and food.

Biography

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