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Influence of Laser Excitation on SERS of Silicon Nanocrystals

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Abstract : Surface enhanced Raman spectroscopy (SERS) of Silicon nano crystals (SiNCs) were obtained using two different laser excitations: 488 nm and 514.5 nm. Silver nano particles were used as plasmonics metal nano particles due to a robust SERS effect that observed when they mixed with SiNCs. SiNCs have been characterized by scanning electron microscopy (SEM), high resolution transmission electron microscopy (HRTEM), atomic force microscopy (AFM), X-ray diffraction (XRD) and X-ray photoelectron spectroscopy (XPS). It is found that the SiNCs are crystalline with an average diameter of 65 nm and FCC lattice. Silver nano particles (AgNPs) of two different sizes were synthesized using photo chemical reduction of AgNO3 with sodium dodecyl sulfate (SDS). The synthesized AgNPs have a polycrystalline structure with an average particle diameter of 100 nm and 30 nm, respectively. A significant enhancement in the SERS intensity was observed for AgNPs100/SiNCs and AgNPs30/SiNCs mixtures increasing up to 9 and 3 times respectively using 488 nm intensity; whereas the intensity of the SERS signal increased up to 7 and 2 times respectively, using 514.5 nm excitation source. The enhancement in SERS intensities occurs as a result of the coupling between the excitation laser light and the plasmon bands of AgNPs; thus this intense field at AgNPs surface couples strongly to SiNCs. The results provide good consensus between the wavelength of the laser excitation source and surface plasmon resonance absorption band of silver nano particles consider to be an important requirement in SERS experiments.

Keywords : silicon nanocrystals (SiNCs), silver nanoparticles (AgNPs), surface enhanced raman spectroscopy (SERS)
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