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Structural and optical properties of shape-dependent gold nanoparticles

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Abstract
At nanoscale, the electrical, optical, and catalytic properties of metal nanoparticles depend on shape and size. In this study, gold nanoparticles (AuNPs) were synthesized using the seed-mediated growth method. Au nanospheres, nanoprisms and nanorods with average sizes of 6 and 68 nm, (70 nm length, 40 nm width) and grain sizes of 14, 20 and 130 nm, respectively; obtained by SEM and TEM. The plasmon absorption bands of Au seeds, nanospheres, nanoprisms were observed to be 395, 511, 543 and 528-629 nm, respectively, using UV-Vis spectroscopy. As the AuNPs shape changed, size increased and the wavelength increased, hence a red-shift was observed. From Raman spectrum, strong and sharp Raman peaks for the three shapes were observed. The XRD patterns confirmed AuNPs with the face-centered cubic (fcc) of gold and crystalline. The crystallite sizes of Au nanorods and Au nanoprisms obtained from XRD studies were 14.65 and 11.44 nm, respectively. The lattice constants of Au nanorods and Au nano-prisms were 4.15 and 4.10 Å, respectively. The structural and optical properties of shape dependent AuNPs were studied. The obtained nanoparticles, Au nanoprisms, nanospheres and nanorods have good applications in organic solar cells, photothermal therapy, sensing and imaging. Therefore, the results indicate that the sizes and shapes of AuNPs can be controlled by using different reducing agents.
Keywords: Gold nanoparticles; Plasmonic effect; synthesis; Au nanorods; Au nanoprisms

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Yes

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MSc

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