Title:	Ultrafast plasmon relaxation dynamics in metal(AU) and near infrared active non-stoichiometric ccemiconductor(Cu2-xS/Se) Nanocrystals
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Abstract:	This thesis highlights the ultrafast plasmon dynamics of metallic (Au) as well as nonstoichiometric semiconductor (Cu2-xS/Se) nano-materials. Plasmonic nanocrystals (NCs) are versatile class of nano materials which remain in the focus of nanoscience research, due to their enormous interest in fundamental science as well as applications. Intriguingly, plasmonic properties of the NCs can be easily manipulated by changing the size, morphology, carrier concentration and reaction temperature during synthesis. Therefore, fundamental studies especially ultrafast transient absorption (TA) measurements of plasmonic nanomaterials is extremely important to optimize the device efficiency made out of the above materials. This thesis discusses ultrafast plasmon dynamics of Au nanoparticles (NPs) embedded in different glassy dielectric films (SiO2 and SiO2-TiO2) under different pump excitation (400 and 700 nm). Along with, temperature dependent plasmon dynamics has also been investigated and electron-phonon scattering time is estimated, which decreases at cryogenic temperature (5K). Further, near infrared (IR) plasmon dynamics in non-stoichiometric Cu2-xS/Se NCs were carried out and perceived TA bleach was span over long IR region due to intra-band transition within the valence band of Cu2- xS/Se NCs. Hole-phonon coupling constant (G) has been estimated for different systems and at different pump excitation. Again hot carrier dynamics of non-stoichiometric Cu2-xSe NCs has been carried out in presence and absence of methylene blue (MB). TA study shows noticeable ultrafast hot hole delocalization in presence of MB. However, when the NCs caped with short chin surface ligand, we observed more prominent hot hole transfer in Cu2-xSe NC system. Furthermore, Cu2-xS NCs were caped with two different surface ligands (oleylamine and oleic acid). Herein, oleic acid has deprotonated functional group and can scavenge hot hole from Cu2-xS NCs more efficiently. Subsequently, we have represented hot hole delocalization dynamics in p-n hetero-junction (Cu2- xSe/CdSe). TA spectra and kinetic demonstrate hot hole delocalization/transfer in hetero nanocrystals. Fabricated thin-film plasmonic device exhibits excellent conductivity in accordance with the results of TA measurements. This thesis work will open up a new avenue for harvesting visible to near infrared photon for the development of modern solar cell, photo-detector and fast photo-device application.
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