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The synthesis and characterization of metallic@semiconductor nanocomposite materials as active ingredients for solar and thermal energy harvesting applications

The synthesis of various stable metallic nanoparticles is increasingly becoming the focus and source of interest, this is due to their key features such as surface plasmonic activity, catalytic activity, and stability, amongst others, these therefore indicate their potential uses for several promising applications. This study describes the synthesis of SnO_2-coated Gold nanostructures, including; nanospheres, nanoprisms, nanooctahedrals, and tip-blobbed nanooctahedrals (these are mono-metallic heteromorphic structures), with the aim to demonstrate the stabilizing effect of SnO_2 on the gold nanostructures. While our understanding of the reaction mechanisms initiated at the metal-semiconductor interface is complicated by a lot of factors including spatial non-uniformities. Herein we also study the various resulting metal-semicondctor systems which might have general relevance in broadenig our understanding of semiconductor stabilization and interaction at the surface of a metal. The wet chemistry approach used in this study has previously been successfully used to synthesize gold nanospheres stabilized with both SnO_2 and SiO_2. From an application perspective, the study intends to demonstrate the potential uses of the stable colloids of gold-semiconductor nanocomposite materials as heat transfer fluid additives, owing to the outstanding heat storage capabilities of the coating semiconductor material and the impeccable surface plasmonic resonance activities of the core metal structures. We also intend on emphesizing their uses in sensor devices and solar cells.
The examinamination of the colloid stabilities using Ultraviolet-Visible spectroscopy (and Zeta potentiometer), demonstrates a clear stabilization by the coating material and absorption enhancement. Furthermore, the elemental analysis measurements carried out using TEM-EDS confirmedl the metal-semiconductor interaction which aided in our description of the proposed reaction mechanisms, from the analysis we also managed to search for other trace products. The structural morphologies of the metal nanomaterials before and after coating were conducted using transmission electron microscopy and secondary electron microscopy, the analysis of the morphologies gives some important insights for other potential future applications.

Apply to be considered for a student ; award (Yes / No)?

Yes

Level for award;(Hons, MSc, PhD, N/A)?

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Primary author: MAKGALE, Tshepho Trevor

Presenter: MAKGALE, Tshepho Trevor

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