Synthesis of Gold-Silver Chalcogenide Hybrid Systems through a New Synthetic Approach

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Developing alternative synthetic route for achieving nanoscale heterostructures can offer more structural and compositional diversities in the system, rather than those obtained by using traditional bottom-up approaches. In this work, a new synthetic route was developed for the synthesis of both Au-Ag_2Se and Au-Ag_2S hybrid systems by directly mixing Au and silver chalcogenides nanoparticles, instead of adding surfactant -Au(III) complexes [1,2] into Ag_2Se and Ag_2S nanostructured semiconductors. The results showed that the Au has partially fused with initial Ag_2Se and Ag_2S, resulting in the formation of two ternary interfaces ($AuAg_3Se_2$ and $AuAg_3S_2$) in between the metallic domain of Au and the initial Ag_2Se and Ag_2S, respectively. Their structures, chemical compositions and optical properties have been studied by electron microscopic techniques, X-ray diffraction and UV/vis spectroscopy. Furthermore, the DFT calculations were also performed to understand the relative thermodynamic stability of the phases involved in the process.

References

[1] *M. Dalmasse et al., Chem. Mater,* 28 (2016) 7017−7028
[2] *M. Dalmasse et al., Chem. Mater,* 30 (2018) 6893−6902

Figures

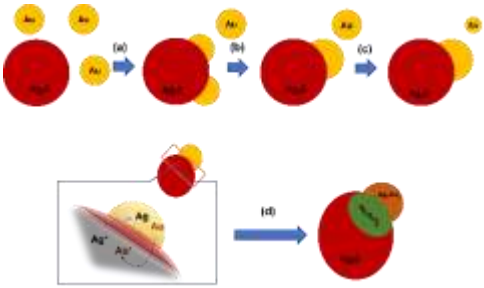

Figure 1: Schematic illustration of the heterodimer formation mechanism. a) NP heteroattachment, b) Au NPs coalescence at the chalcogenide surface, c) solution-mediate Au NPs ripening, and d) solid interface-confined galvanic replacement.