Engineering Heterostructures of Zn-rich Layered Double Hydroxides and Gold Nanoparticles for Plasmon-Enhanced Catalysis

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Abstract

Artificially designed heterostructures formed by close conjunctions of gold nanoparticles (AuNP) and (2D) lamellar nanostructures are receiving extensive interests. The synergistic interactions of the joined nanounits induce the manifestation of localized surface plasmon resonance (LSPR) of nanogold in the specific environment of the 2D-light absorbing matrix impacting their potential in plasmonic responsive catalysis. Specifically, layered double hydroxides (LDH) with the advantages of their unique 2D-layered structure, tuned optical absorption, ease of preparation, composition diversity and high surface area, have emerged as very promising candidates for obtaining versatile and robust catalysts. We present AuNP/Zn-rich LDH heterostructures mainly focusing on their synthesis strategies toward establishing a synergistic response of the coupled nanounits, their characteristics and specific applications as plasmonic responsive catalysts. We highlight here the synthesis strategies based on the structural reconstruction by memory effect of Zn-rich LDH and the emerging functionalities that enable the manifestation of the plasmon-induced charge separation effect (PICS), co-catalytic effect or nanoantenna effect applied in solar driven photocatalysis [1]. This results in the plasmonic response (see Fig.1) and functional versatility of AuNP/Zn-rich LDH heterostructures toward developing highly performant plasmonic driven catalysts for applications in advanced chemical processes.

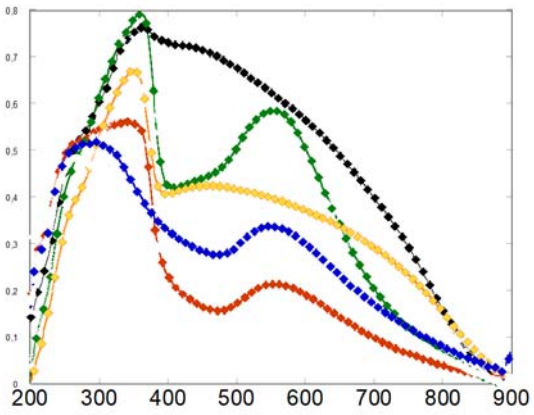

Fig. 1. UVVis spectra of UV-Vis spectra of (-)AuLDHZn; (-) AuLDHCu; (-) AuLDHZn550; (-) AuLDHCu550; (-).

[1] results submitted to publication.

Research and Highlights: plasmonic responsive heterostructures; layered double hydroxides; plasmonic catalysis