

Hollow PdAg/CeO₂ heterodimer nanocrystals as structured catalyst for the selective hydrogenation of alkynes

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In the present work, we report a facile synthesis of a new class of heterodimer nanocrystals (NCs) with alloyed hollow morphologies (PdAg/CeO₂) via the galvanic replacement reaction between Ag/CeO₂ NCs used as sacrificial templates and K₂PdCl₆ used as Pd precursor, these heterodimer NCs were tested as catalysts for the selective hydrogenation of alkynes.

These new nanostructures combine the beneficial effect of alloying Pd with Ag in a single NC hollow domain with the formation of active sites at the interface with the CeO₂ counterpart. The PdAg/CeO₂ NCs display well to excellent alkene selectivity for aliphatic alkynes. For the specific case of hydrogenation of internal alkynes such as 4-octyne, very low over-hydrogenation and isomerization products were observed over a full conversion regime, even after prolonged reaction times. These catalytic properties were remarkably superior in comparison to commercial Pd-based monometallic catalysts and similar or superior to industrial standards, such as the Lindlar catalyst. These effects were attributed to firstly, the promotional effect of Ag on the moderation of the reactivity of the Pd phase, and secondly, a synergic effect between the CeO₂ NCs and the hollow bimetallic alloy at their interface.

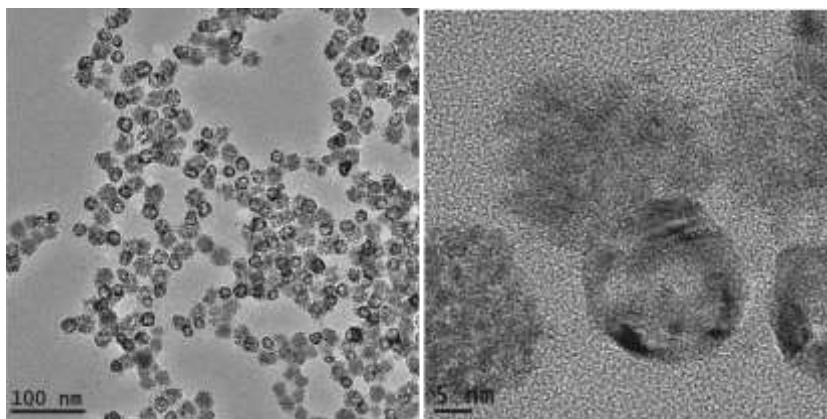


Figure 1: TEM images of PdAg/CeO₂ heterodimer nanocrystals