

Self-assembled materials based on metallic nanoparticles for heterogeneous catalysis

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The ability to design and prepare materials with atomic scale accuracy is nowadays of paramount importance in order to gain new and unexpected properties. This has been recently demonstrated by the preparation of advanced materials such as nanoparticles arrays, organic spintronics, semiconductor nanocrystals, modified carbon nanotubes, metal-organic frameworks.¹ In this contest, the exponentially increasing interest on core-shell structures is mainly due to their new physical and chemical characteristics, often different and improved from their constituent single-component counterparts. However, the dispersability of the core-shell structures is one of the key properties required for their technological applications, since formation of aggregates of particles is unacceptable. We report the design of a route to obtain dispersible Pd@CeO₂ core-shell structures (Figure 1). In addition to the well recognized importance of the CeO₂ component, Pd is a metal of great interest for its large use in catalysis, fuel cells and electrochemistry. We describe the pre-organization and the self-assembly in solution of the composing parts leading to Pd@CeO₂ core-shell structures dispersible in low polar organic solvents, such as THF, dichloromethane, toluene and hexane. Our strategy exploits functionalized monolayer-protected Pd nanoparticles (PdNs) and cerium alkoxides as self-assembling building blocks. Classical and advanced characterization techniques have been used to demonstrate the structure of such systems. These core-shell systems can be of potential interest in heterogeneous catalysis.

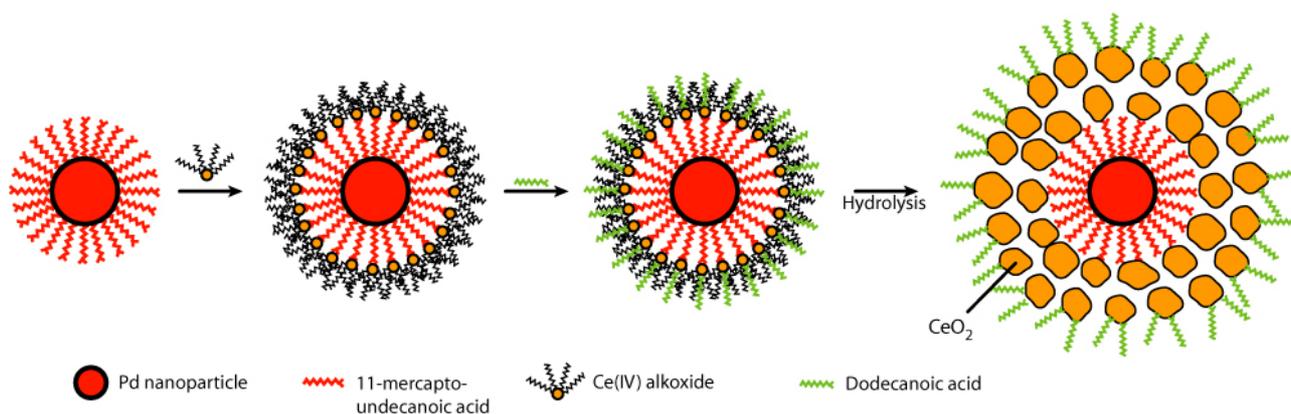


Figure 1. Schematic representation of the procedure employed to prepare dispersible Pd@CeO₂ nanostructures.

References

[1] (a) Redl, F. X. et al. *Nature* **2003**, 423, 968; (b) Rocha, A. R. et al. *Nature Materials* **2005**, 4, 335; (c) Peng, X. et al. *Nature* **2000**, 404, 59; (d) Ehli, C. et al. *Nature Chemistry* **2009**, 1, 243; (e) Li, H. et al. *Nature* **1999**, 402, 276.