

Colloidal Synthesis of Complex Multicomponent Inorganic Nanocrystals

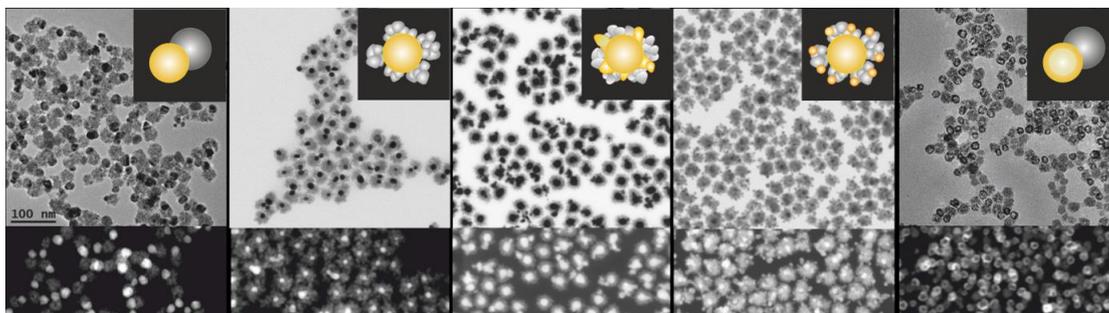
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The rational design and development of new protocols for the colloidal synthesis of multicomponent nanocrystals (NCs) represent an important research direction to expand the functionalities of single-component counterparts¹. In these systems, the functionality of the composite NCs is ultimately determined by the atomic interactions between constituent domains, which essentially relies on the precise and deliberate control of the NC architecture with the independent organization of each individual domain. Consequently, the controllable integration of different functionalities into single nanostructures has recently become one of the hottest research topics due to the unique structural features and synergetic optical and catalytic properties that these complex nanocrystals (NCs) possess. In quest of developing advanced functional NCs, the design of the nanostructures has become quite sophisticated through controlling the size, shape and crystal structure of the constituent domains. However, a long-standing barrier has been the development of simple and cost-effective synthetic processes allowing a fine adjustment of the structure and interface of these systems, especially in water.

In this context, we present a general approach for the preparation colloidal solutions of multicomponent NCs that allow the fine adjustment of the final composition, location engineering, dimensionality, and surface structure of each individual domain. We present the model case of Au/CeO₂ and Ag/CeO₂ hybrid NCs with precise control of their size and morphology²⁻³. Moreover, by using these NCs as a template and adopting the galvanic replacement reaction to oxidize the Ag counterpart, hollow hybrid structures AgAu/CeO₂, PtAg/CeO₂, and PdAg/CeO₂ can be prepared. The combination of noble metal and CeO₂ domains in a well-defined architecture represents the possibility to tune the optical and catalytic activity and selectivity of the resultant NCs⁴.



References:

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