# TOPOLOGICALLY CONTROLLED GROWTH OF MAGNETIC-METAL-FUNCTIONALIZED SEMICONDUCTOR OXIDE NANORODS

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The development of colloidal hybrid nanocrystals (HNCs), in which two or more material sections with peculiar chemical, optical, magnetic and/or catalytic properties are connected by epitaxial interfaces, represents an emerging field of great interest in nanoscience.[1] Nanocrystal heterostructures, characterized by a topologically controlled distribution of their chemical composition, are extremely attractive as advanced generations of nano-objects potentially able to perform multiple tasks in optoelectronic devices, biomedical engineering, diagnostics, sensing, and catalysis.[(2-10)] To date, the chemical fabrication of HNCs remains a challenging task, as the ability to tailor the size and shape of the individual material domains has to be integrated with the control over additional parameters at the nanoscale, such as inter-compound miscibility, interfacial strain, and facet-specific chemical reactivity.

Here we present a seeded growth approach to synthesize a novel type of colloidal semiconductor/magnetic-metal HNCs, each made of spherical ε-Co domains epitaxially attached to one anatase $TiO_2$ rod-shaped portion.[(10)] We have been able to control the heterogeneous nucleation of spherical ε-Co domains onto preformed $TiO_2$ nanorods in suitable surfactant mixture, achieving metal deposition on either the tips or on multiple locations along the longitudinal sidewalls of the oxide seeds. A detailed compositional, structural, and magnetic characterization of the as-prepared heterostructures has been carried out by combining powder X-ray Diffraction, high angle annular dark field (HAADF) imaging, and high-resolution transmission electron microscopy (HRTEM) analyses, superconducting quantum interference device (SQUID) magnetic measurements. Our results suggest that the possibility of switching between either $TiO_2$-Co HNC topologies arises from the facet-dependent chemical reactivity of the $TiO_2$ seeds, which is mainly governed by surface selective adhesion of the surfactants, rather than by misfit-related interfacial strain at the relevant junction points. These $TiO_2$-Co HNCs could find relevant applications as bi-functional, magnetically recoverable (photo)catalysts and as active elements in novel magneto-optical applications.

## References


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