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Hybrid metal/inorganic/organic nanotubes

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Hybrid nanoparticles are gaining increased recognition for their importance in many areas including catalysis, medicine, and light-harvesting. The ability to tune the properties of these hybrids is thus of great interest; furthermore, such structures can be subject to additional processing to form unique structures. This work presents the coating of gold nanoparticles (GNPs) on an inorganic nanotube (WS2-NT) template, linking of the GNPs by ligands, and finally etching away the NT to leave a robust, yet hollow cylinder formed of GNPs. This preparation differs from previous attempts to coat nanostructures by nanoparticles using defect-guided processes in that our method is specific and efficient, resulting in a controlled and uniform coverage as well as the possibility to remove the original template leaving an intact nanotubule. Characterization of the mechanical, thermal, electrical and electro-optical properties of these new species was performed using x-ray diffraction, electron microscopy, Raman spectroscopy, and a variety of scanning probed microscopy (SPM) techniques. Here, emphasis will be placed on the SPM measurements which show distinct electrical and mechanical behavior distinguishing the decorated tubes, and etched final products. These results will be compared to the other techniques applied, and used to understand the nature of the networking between the GNPs, and how it affects the mechanical integrity, electrical and optical properties of the resultant structures.

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