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TUBULAR PHOTOACTIVE GOLD NANOPARTICLE ASSEMBLIES

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Nanotubes of WS₂ (INT-WS₂) have been uniformly decorated with 5 nm tetraoctyl ammonium bromide stabilized gold nanoparticles (AuNP). The interparticle distance of AuNP is 2 nm. This self-assembly process is likely to be driven by the lattice matching between the nanotube outer wall and AuNP and strengthened by the affinity of disulfide binding with Au. The optical band gap of INT-WS₂ can be varied from 1.82 eV for the bare nanotube to 1.75 eV for full AuNP coverage. AuNP decorated nanotubes are further functionalized with robust pyridine-based ruthenium complexes. The complexes adhere and link the surface-bound AuNPs through ligand exchange. The resulting network of AuNPs forms a coherent, tubular shell that persists even after complete removal of the underlying INT-WS₂ with hydrogen peroxide. The oxidation process is studied by electron microscopy and optical microscopy. Raman spectroscopic measurements of the single-walled AuNP tube shells depict the presence of the metal complex. The mechanical properties of the AuNP-tubes are studied by AFM-based nanoindentation. This study indicates tubular structure is elastic in nature with stiffness dominated by interactions between the AuNPs.