

Supporting Information

Heterogeneous Growth of Palladium Nanocrystals on Upconversion Nanoparticles for Multimodal Imaging and Photothermal Therapy

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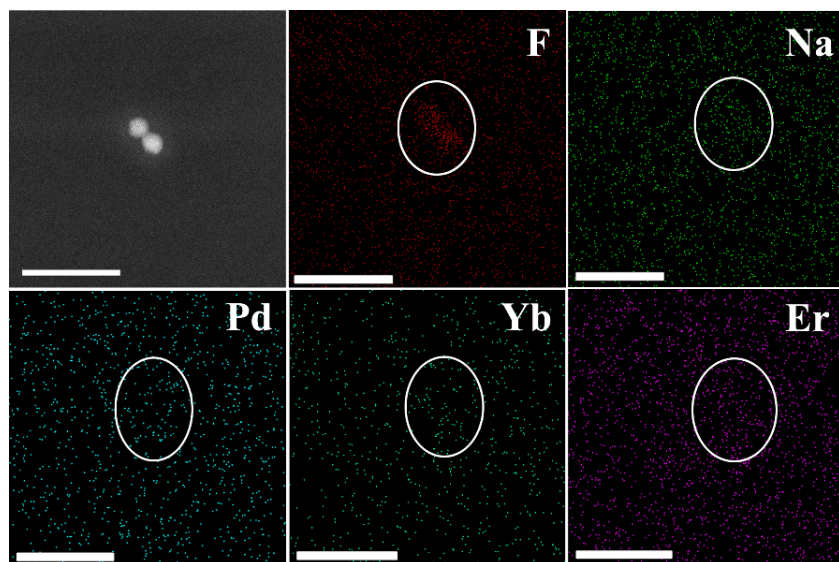


Fig. S1. Elemental mapping images (elemental color distribution, F, Na, Pd, Yb, and Er) of UCNPs@Pd-PVP nanocomposites.

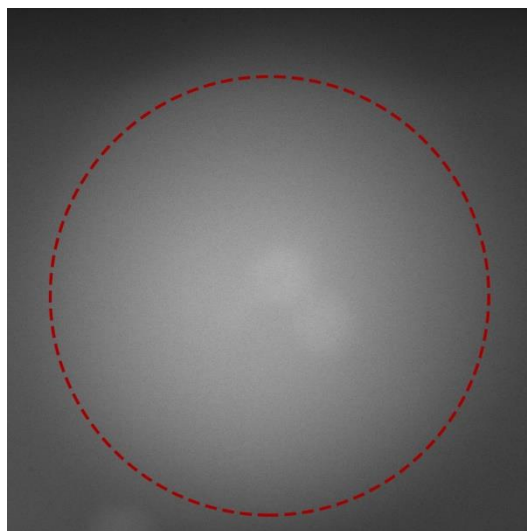


Fig. S2. Scanning transmission electron microscope-High angle annular dark field (STEM-HAADF) image of UCNPs@Pd-PVP nanocomposites.

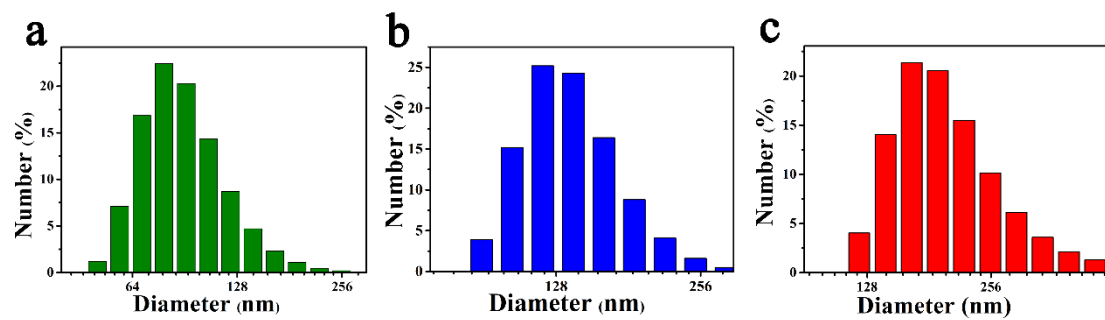


Fig. S3. Dynamic Light Scattering (DLS) of UCNPs (a), UCNPs@Pd (b), and UCNPs@Pd-PVP (c) in water. The polydispersity index (PDI) of Fig. S3 a-c is 0.195, 0.115, and 0.211, respectively.

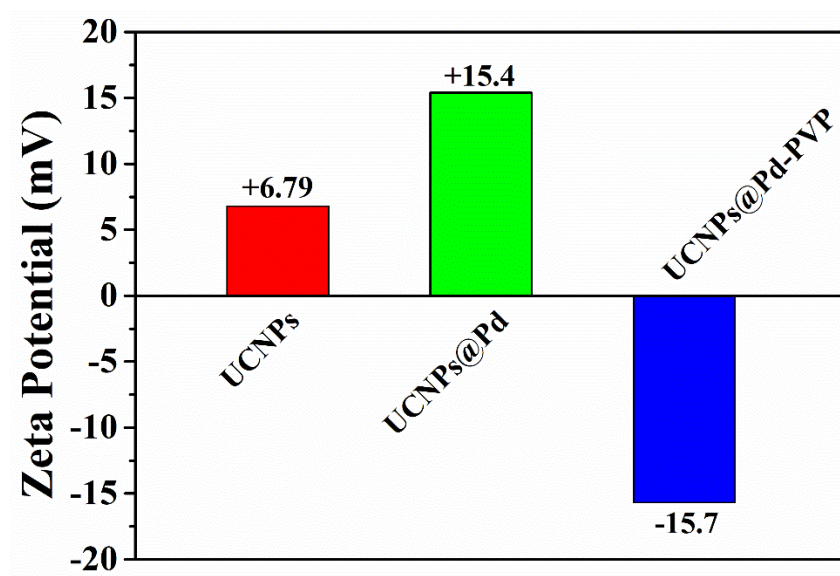


Fig. S4. The zeta potentials of UCNPs, UCNPs@Pd, and UCNPs@Pd-PVP in water, respectively.

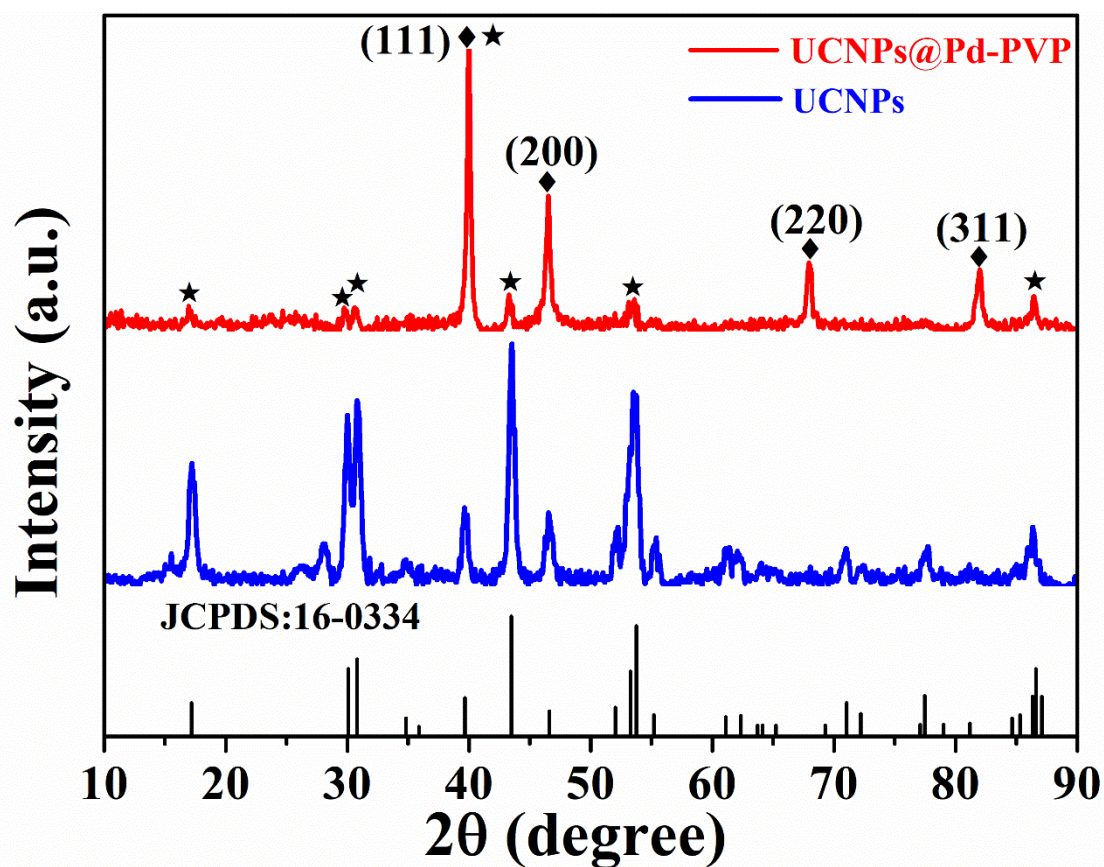


Fig. S5. The X-ray diffraction (XRD) patterns of UCNPs, UCNPs@Pd-PVP, and the standard card of β -NaYF₄ (JCPDS: 16-0334). ◆: the peaks of palladium nanocrystal, ★: the peaks of UCNPs.

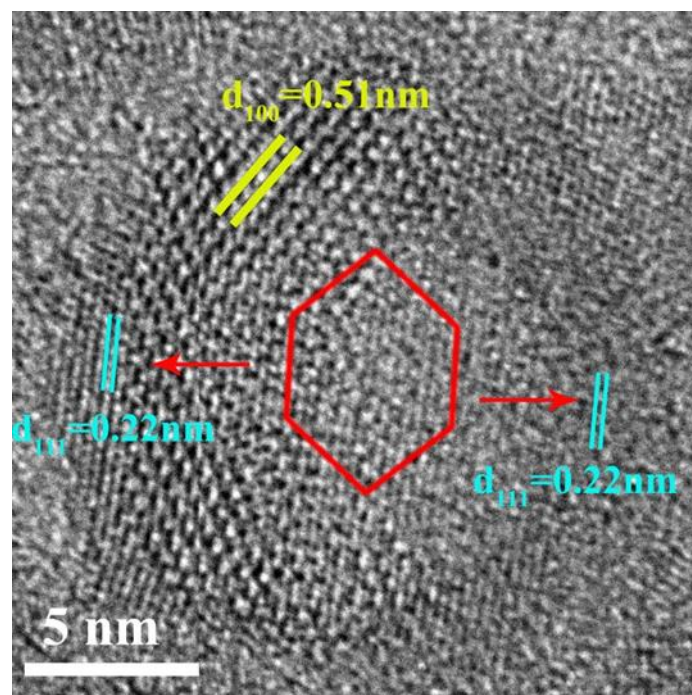


Fig. S6. High-resolution TEM (HRTEM) image of UCNPs@Pd-PVP nanocomposites. The red arrow indicates the direction of parallel growth of Pd on the UCNPs.

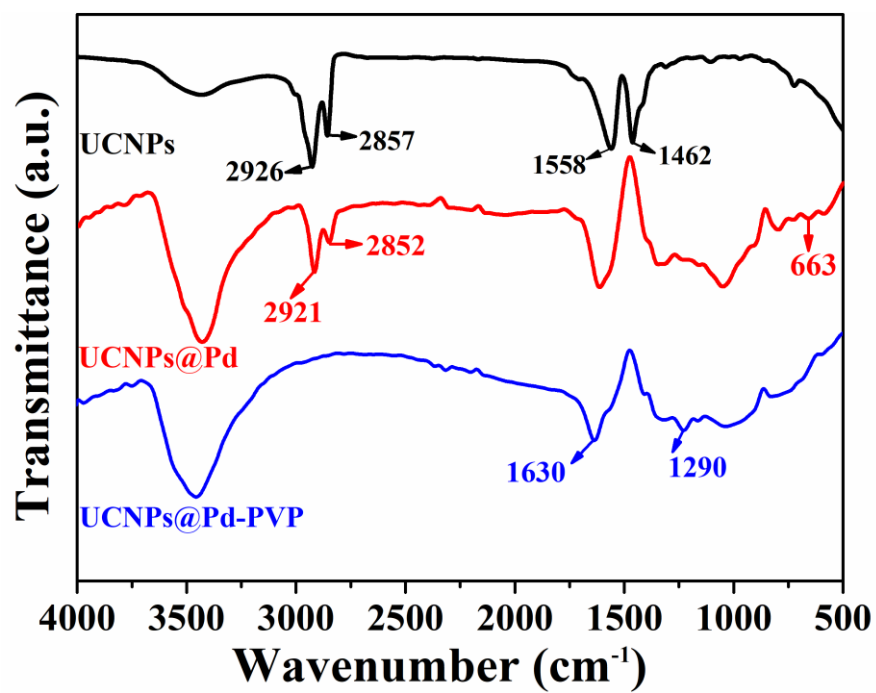


Fig. S7. FTIR spectra of UCNPs, UCNPs@Pd, and UCNPs@Pd-PVP.

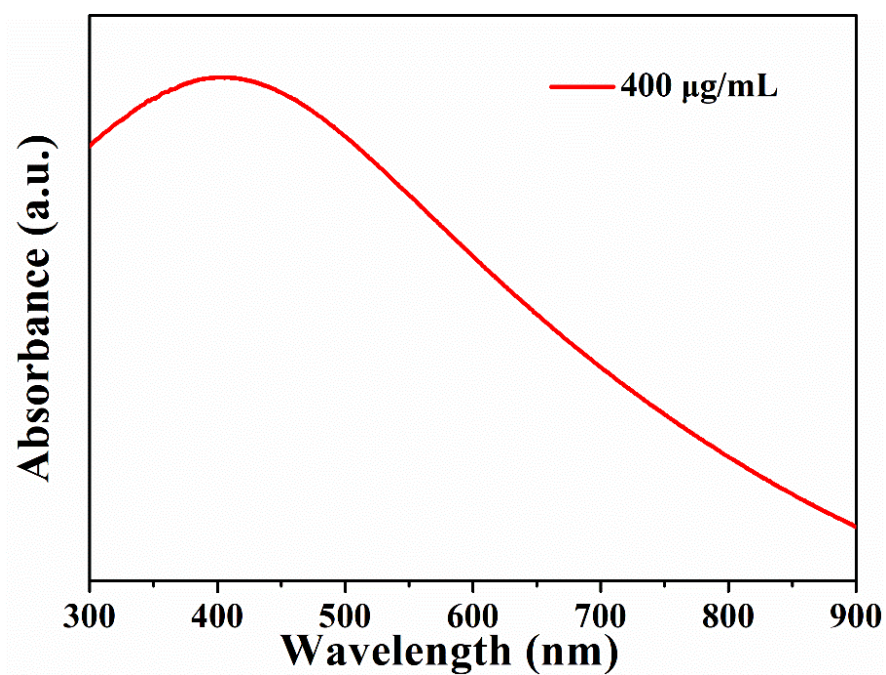


Fig. S8. UV-visible absorption spectrum of UCNPs@Pd-PVP nanocomposites in water (400 µg/mL).

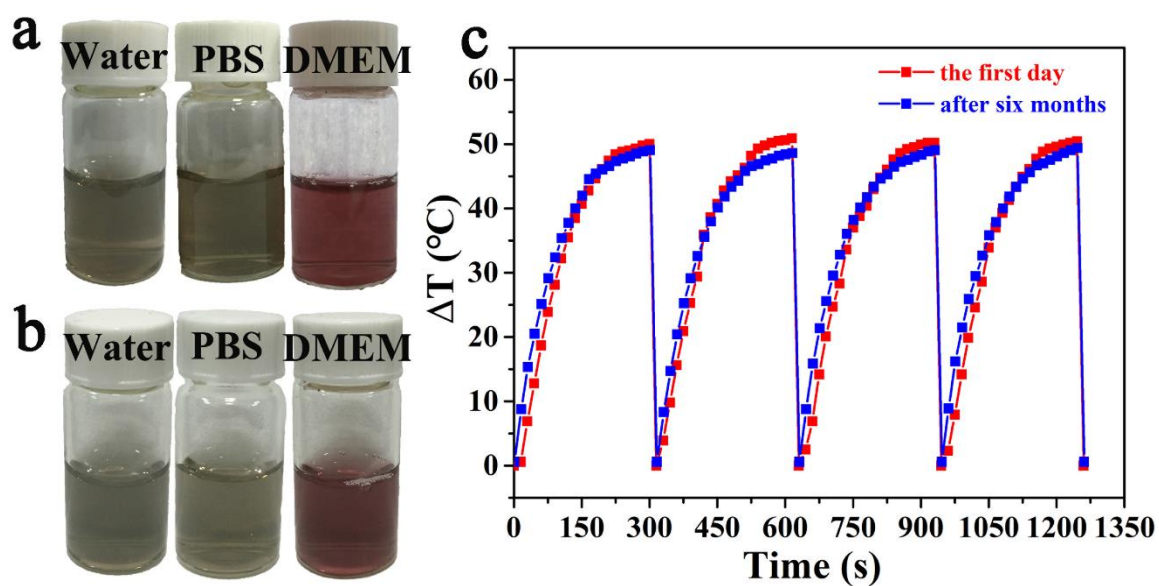


Fig. S9. The photos of UCNPs@Pd-PVP nanocomposites in water, PBS (pH = 7.4), and DMEM culture solution, respectively (a) and after being placed in the lab at room temperature for one week (b), and the photothermal stability of UCNPs@Pd-PVP nanocomposites in water (400 $\mu\text{g/mL}$) for four laser on/off cycles on the first day and after being placed for six months, respectively (c).

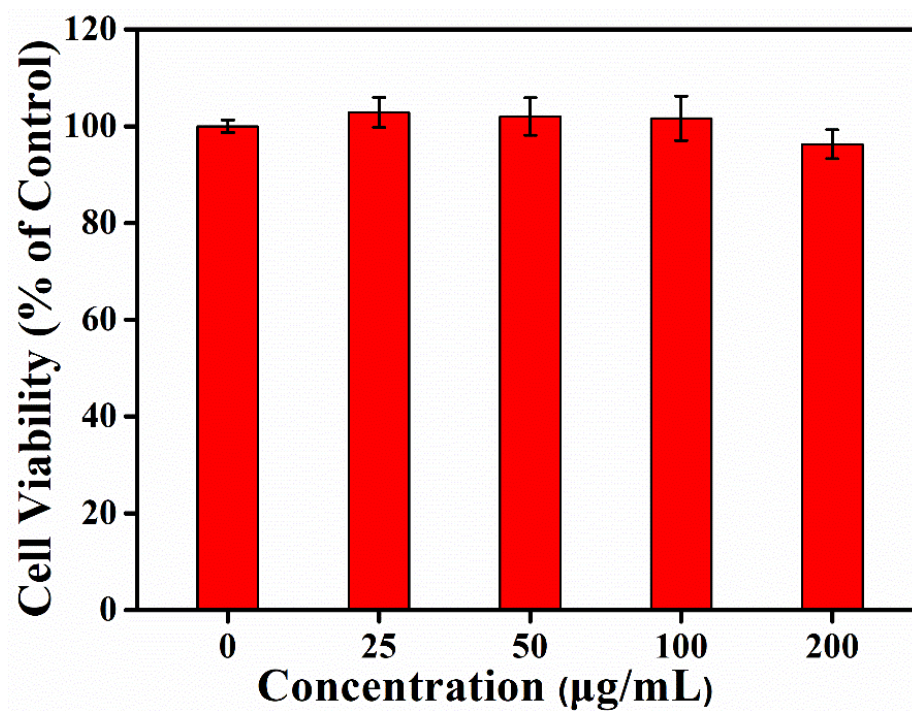


Fig. S10. Viability of HeLa cells treated with UCNPs@Pd-PVP nanocomposites (0, 25, 50, 100, and 200 µg/mL) for 24 h.

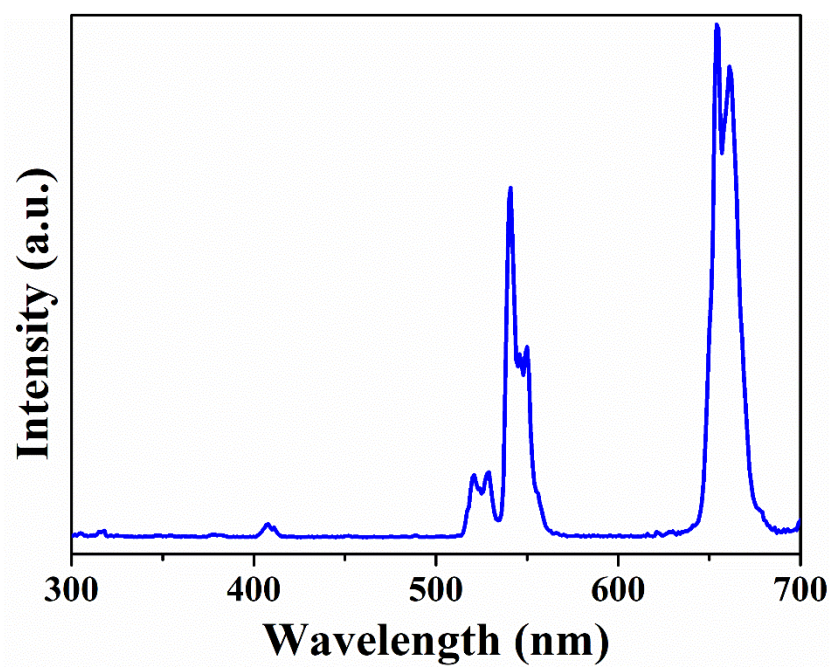


Fig. S11. Upconversion luminescence (UCL) spectrum of UCNPs@Pd-PVP nanocomposites (excited at 980 nm)