

Upconversion nanoparticles for NIR-induced photopolymerization in highly turbid medium

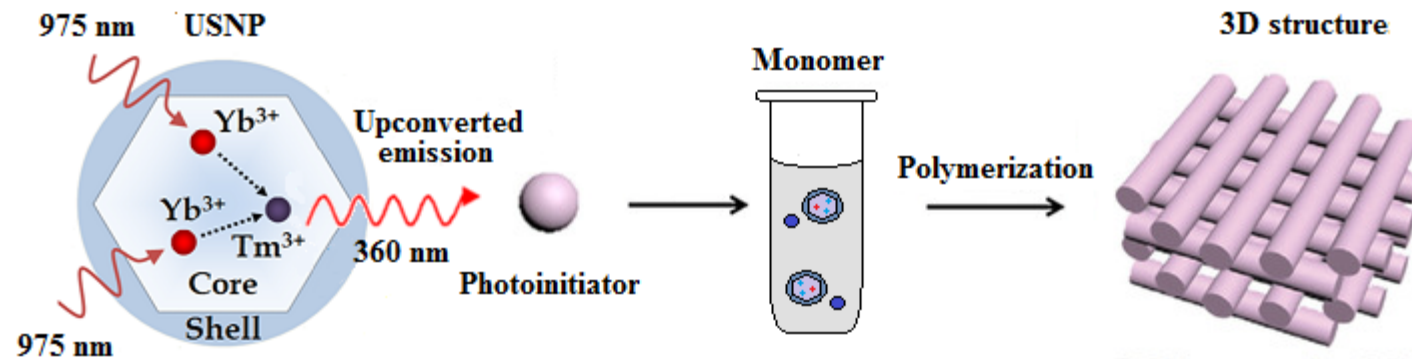


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NIR to UV-blue light conversion

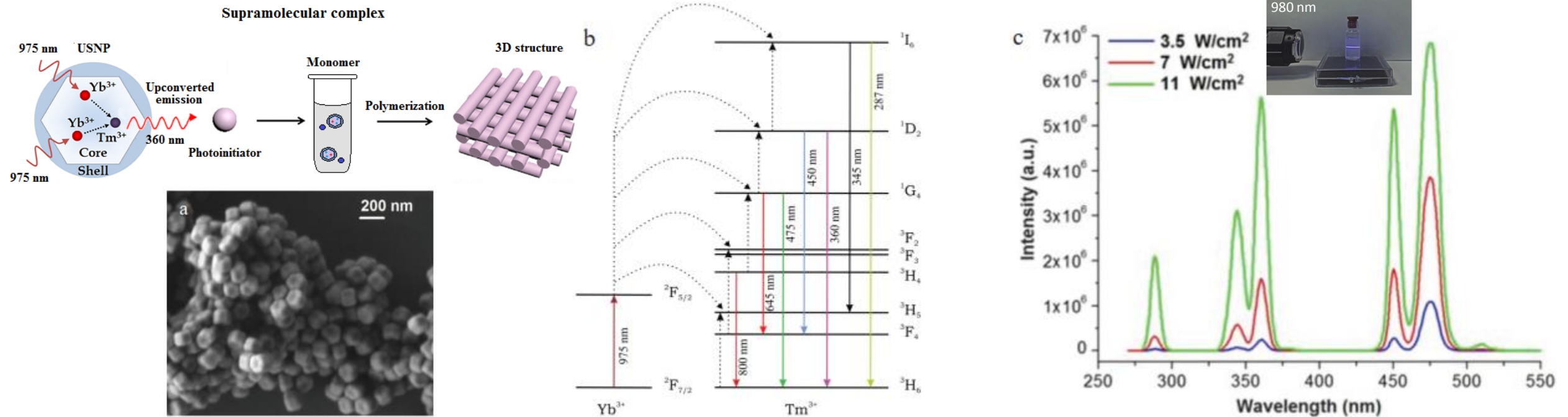


Fig. 1. (a) SEM image of synthesized $\beta\text{-NaYF}_4:\text{Yb}^{3+},\text{Tm}^{3+}/\text{NaYF}_4$ core/shell nanoparticles. (b) Energy-level diagram of anti-Stokes processes in UCNPs ($\text{NaYF}_4:\text{Yb},\text{Er}/\text{Tm}$). (c) Upconverted luminescence spectrum of the UCNPs in hexan when excited by 975 nm CW diode laser at power density of 3.5, 7 and 11 W/cm². The inset shows photograph of the transparent solution without laser illumination and the upconverted visible luminescence under laser illumination.

Voxel formation

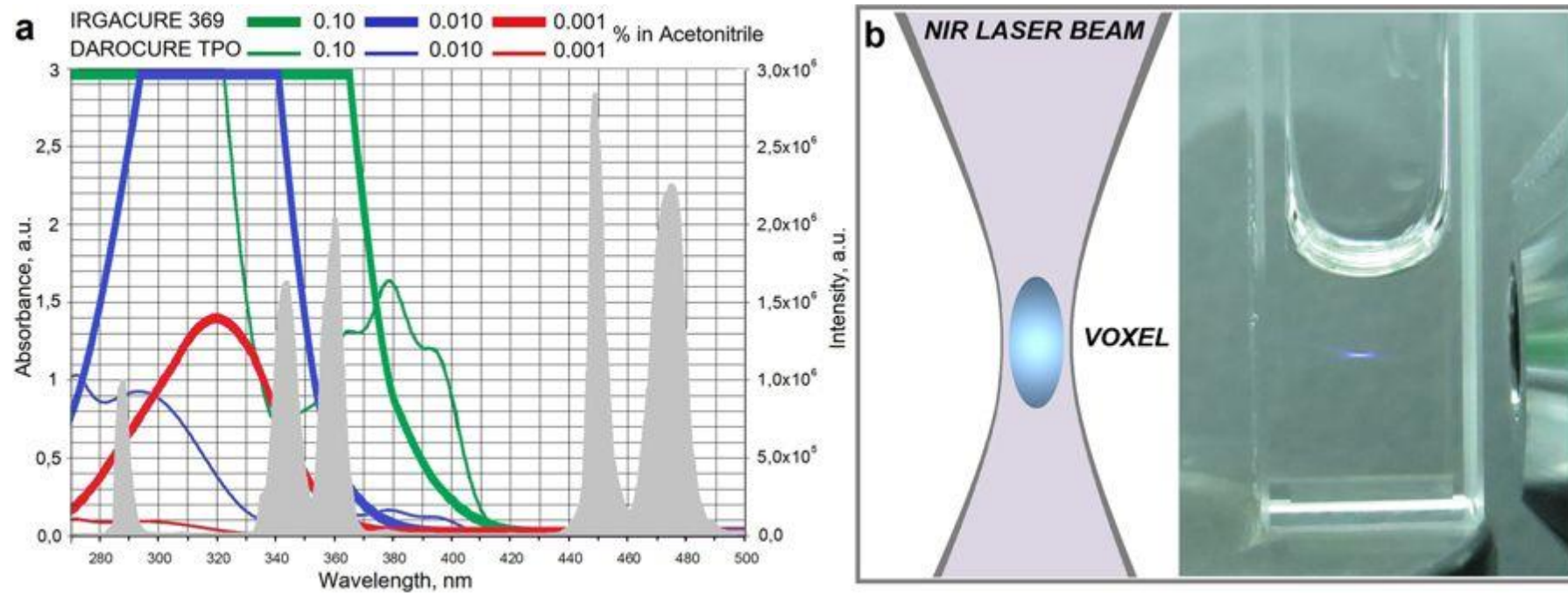


Fig. 2. (a) Overlap of the absorption spectra of photoinitiators and the emission spectrum of the UCNPs. (b) Luminescent voxel formation in cuvette containing light-sensitive resin impregnated with UCNPs.

Microstructures for tissue engineering

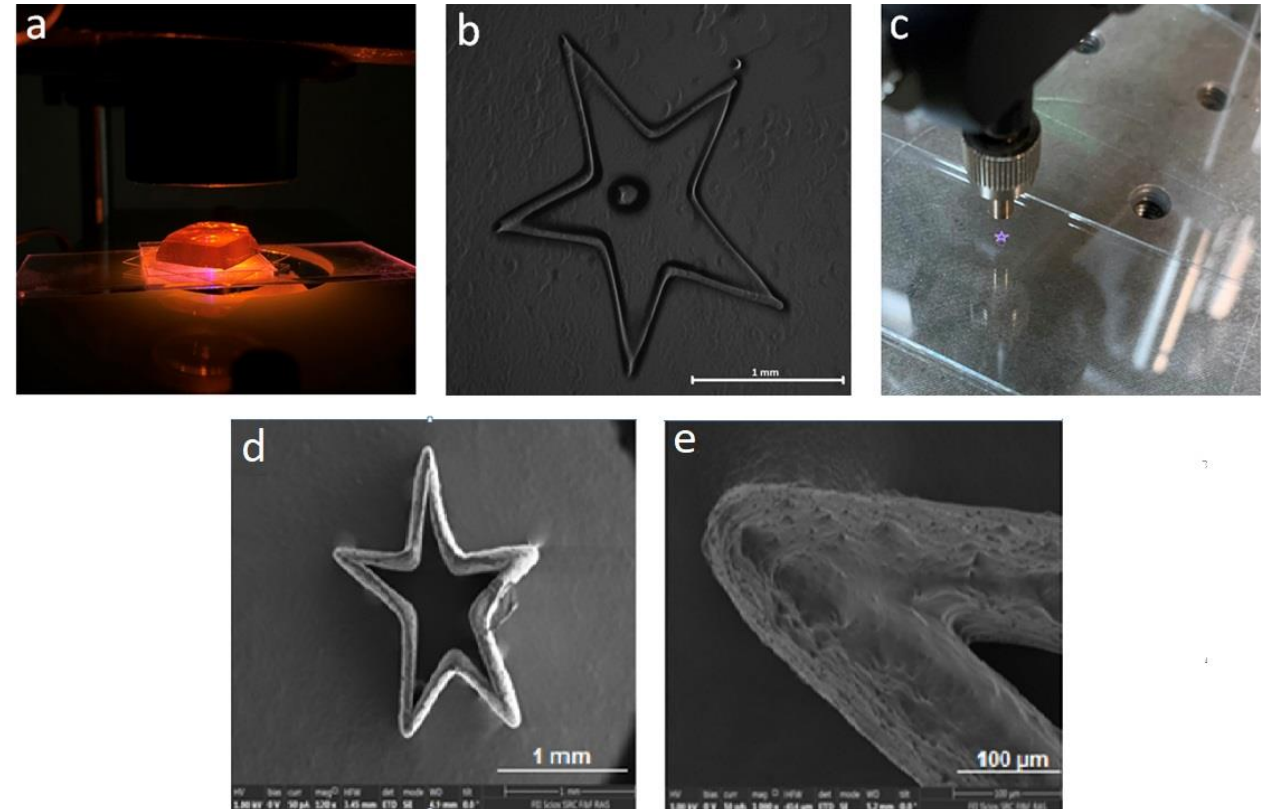
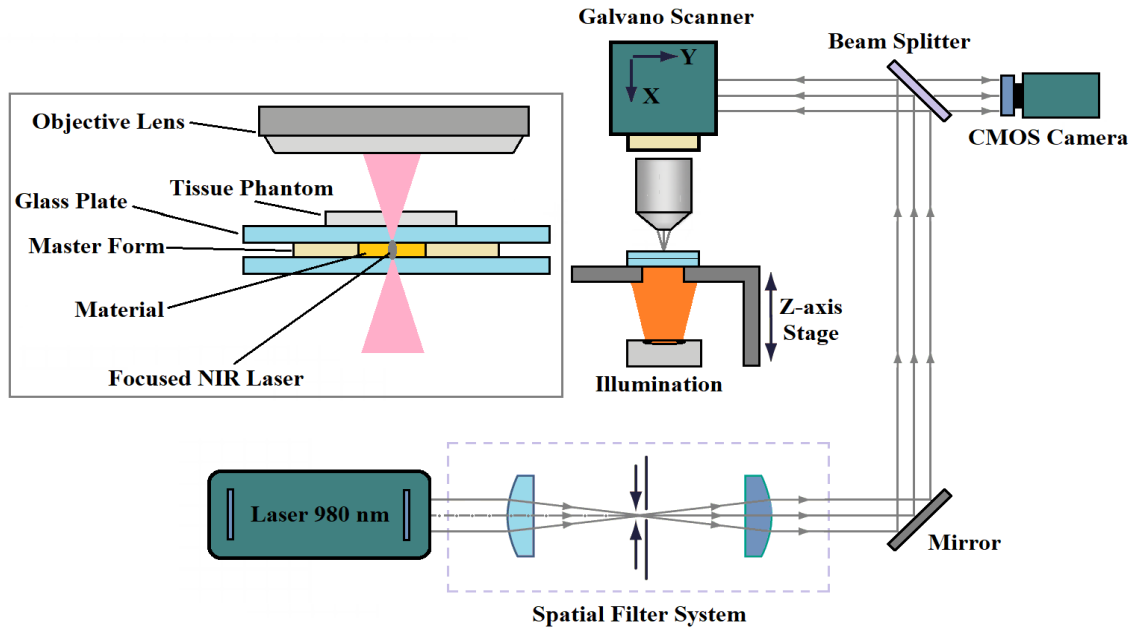
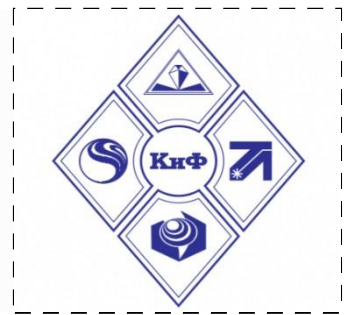
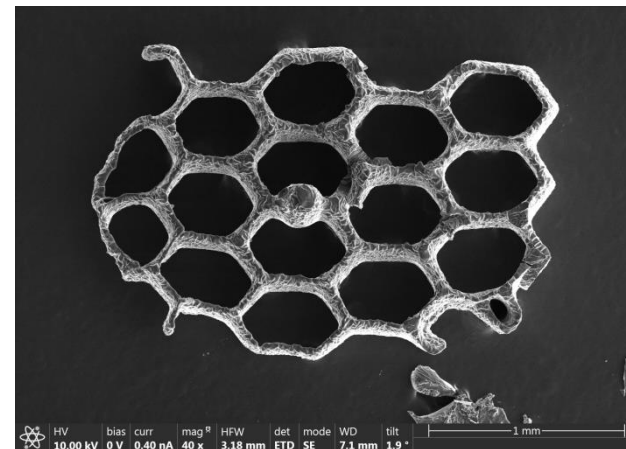
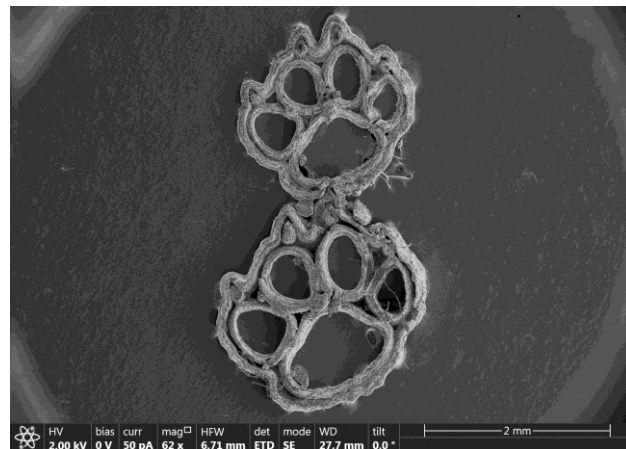
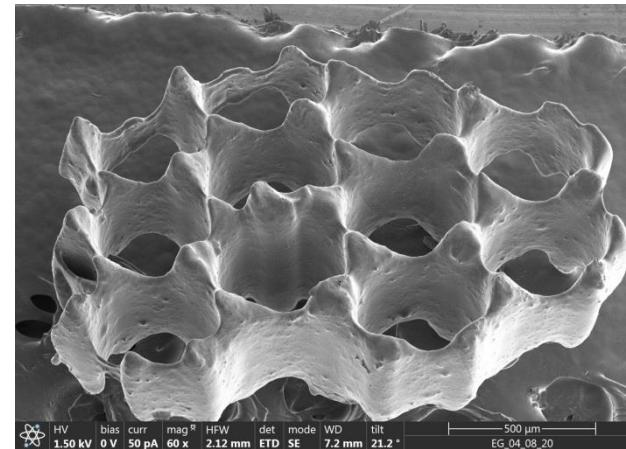
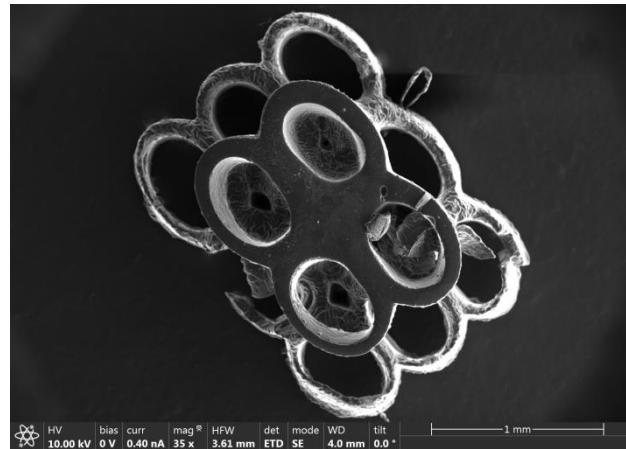


Fig. 3 . Scheme of the experimental setup for fabrication of 3D polymeric structures in PCC containing UCNPs under NIR irradiation.

Fig. 4. Photocuring of polymers under biological tissue-equivalent phantom: photocuring process(a), star-shaped microstructure produced in the volume of liquid PCC(b), luminescence of the sample after developing under NIR excitation(c). SEM photograph of a three-dimensional microstructure in the shape of the star 1.2 mm long, 0.2 mm wall height (d, e).

SEM images of 3D polymer microstructures



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