Dual Energy Conversion Approach with Coumarin Dye and Upconversion Nanoparticle Encapsulated Polymer Composite on Microsystem for Enhanced Photoredox Catalysis

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Utilizing light is significantly necessary issue in terms of achieving enhanced photoredox catalysis in organic synthesis. To improving the performance of photocatalysts, microsystem has been a crucial role in the photon driven synthetic chemistry. Herein, novel organocarbosilane based polymer nanocomposites containing organic dye (Coumarin153) and upconversion nanoparticle (UCNP) are rationally designed and uniformly dispersed to achieve the extended absorption range through dual energy conversion. In the well-organized nanocomposites, Coumarin153 absorbs UV-Visible light (390~490 nm) to down-convert to 500~580 nm whereas yellow-emission UCNP absorbs NIR light (980 nm) to up-convert to the emission of 500~580 nm, also, corresponding to absorption range of Rose Bengal (RB). As a result, the fabricated nanocomposite-microfluidic chip on PDMS shows more than 30% higher photocatalysis under white LED and IR laser, than the only RB used at aza-Henry reaction.