Designed Fabrication of Nanostructured Materials based on Uniform Nanoparticles and their for Biomedical Applications

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We developed a new T1 MRI contrast agent using biocompatible manganese oxide (MnO) nanoparticles. When the MnO nanoparticles were injected bolus to a mouse through a tail vein line, the detailed anatomic structures of the brain, kidney, and spinal cord, were depicted in contrast enhanced T_1-weighted MRI. Furthermore, functionalized MnO nanoparticles prepared by conjugation with a tumor specific antibody were used for imaging selectively the breast cancer cells in the metastatic brain tumor model. We reported on the fabrication of monodisperse nanoparticles embedded in uniform pore-sized mesoporous silica spheres and PLGA polymers. We fabricated magnetic gold nanoshells consisting of gold nanoshells (for NIR photothermal therapy) that are embedded with Fe_3O_4 nanoparticles (for MRI contrasting agent), and conjugated them with cancer targeting agent (for targeting). Cancer cells targeted with magnetic gold nanoshells were detectable by a clinical MRI system and rapidly destroyed by exposing them to femtosecond laser pulses of NIR wavelength at a low power. We synthesized Ni/NiO core/shell nanoparticles and applied them to the selective binding and subsequent magnetic separation of histidine-tagged proteins.