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Plasmonic nanostructures for imaging and targeting drug delivery

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Engineering a compact, near-infrared plasmonic nanostructure with integrated image-enhancing agents for combined imaging and therapy is an important nanomedical challenge. To overcome this challenge we designed a nanostructure with NIR plasmonic signatures composed of a 50 nm Au core surrounded a SiO₂ inner-shell doped with contrast agents and an outer Au shell. The plasmon resonance of this nanostructure, known as a nanomatryoshka (NM), can be tuned to the desired wavelength by varying the thickness of the layers. The encapsulated contrast agents used in this study

are: Fe(III)-DOTA, Gd(III)-DOTA, and fluorescent dyes. The Fe(III)-NM based contrast agents are found to have relaxivities two times greater than the widely used Gd(III)-DOTA, providing a practical alternative for T₁ MRI contrast agent that eliminates Gd(III) patient exposure entirely. Additionally, the internalization of fluorescent dyes and MRI contrast imaging agents within the NM substantially reduces the toxicity while maintaining a free nanoparticles surface for further bio-functionalization.

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