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Shaped magnetic composites as dual modal targeted molecular CT/MRI imaging tools of Hepatocarcinoma

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In this study, we report on the synthesis and characterization of shaped iron oxide core palladium shell (Fe₂O₃-Pd) as three-modality image agents in magnetic resonance imaging (MRI), computed tomography (CT) and photoacoustic (PAT) imaging. Four shapes were synthesized such as: triangular plates, tetrapods, pyramidal structures and pentagon shaped nanoparticles. We report for the first time their synthesis using an original approach by uniformly fusing multiple components and by controlling their structural (i.e., size, shell thickness, dimer shape) and physical characteristics (i.e., optical, and acoustic). To confer enhanced properties for efficient targeted capability, the surface of the nanoparticles was modified with (i) the amphiphilic diblock polymer and (ii) functionalized with the ligands targeting transferrin receptor (Tr). As a result, the newly created shaped nanoparticles were characterized via different optical and imaging techniques (HR-TEM, STEM, XPS, EDX, Z-potential, UV-VIS). We show that the shaped Fe₂O₃-Pd are stable and biocompatible in given Fe concentrations range and display shaped control MRI/CT/PAT attenuation intensity. The attenuation intensity subsequently decreases as follows: tetrapods>pyramidal>pentagons>triangular plates. Moreover, these shaped nanoparticles enable targeting imaging of hepatocarcinoma tumor cells that have a high expression of the transferrin receptor. These findings conclude that the designed Fe₂O₃-Pd are promising contrast agents for targeted MRI/CT/PAT molecular imaging.

Biography

Anamaria Orza focuses primarily on the area of development of innovative architectural nano composites for biomedical applications. Prior to her arrival at Emory in the fall of 2013, she served as a Postdoctoral researcher at the Center for Integrative Nanotechnology Sciences at the University of Arkansas at Little Rock. She has been recognized as a European Union fellow, receiving her PhD in Chemistry from Babes Bolyai University, Romania and working in close collaboration with Liverpool University, United Kingdom. She has authored and co-authored 2 patents and over 32 papers in leading journals and at leading international conferences in the field (with over 170 citations) and 2 book chapters in the fields of Applied Nanotechnology in Cancer Research and Tissue Engineering.

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