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α-Fe_2O_3@Pt heterostructure particles to enable sonodynamic therapy with self-supplied O_2 and imaging-guidance

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Abstract

Sonodynamic therapy (SDT), presenting spatial and temporal control of ROS generation triggered by ultrasound field, has attracted considerable attention in tumor treatment. However, its therapeutic efficacy is severely hindered by the intrinsic hypoxia of solid tumor and the lack of smart design in material band structure. Here in study, fine α-Fe_2O_3 nanoparticles armored with Pt nanocrystals (α-Fe_2O_3@Pt) was investigated as an alternative SDT agent with ingenious bandgap and structural design. The Schottky barrier, due to its unique heterostructure, suppresses the recombination of sono-induced electrons and holes, enabling superior ROS generation. More importantly, the composite nanoparticles may effectively trigger a reoxygenation phenomenon to supply sufficient content of oxygen, favoring the ROS induction under the hypoxic condition and its extra role played for ultrasound imaging. In consequence, α-Fe_2O_3@Pt appears to enable effective tumor inhibition with imaging guidance, both in vitro and in vivo. This study has therefore demonstrated a highly potential platform for ultrasound-driven tumor theranostic, which may spark a series of further explorations in therapeutic systems with more rational material design.

Keywords: Heterostructure, Sonodynamic therapy, Self-supplied oxygen, Tumor theranostic

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