Supplementary Information for Nanoscale

Composition-Property Relationships in Multifunctional Hollow Mesoporous Carbon Nanosystems for PH-Responsive Magnetic Resonance Imaging and On-Demand Drug Releasing

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Figure S1. (a) *In vitro* ultrasound imaging (Harmonic mode) results of MnOx-HMCNs aqueous solution at different concentrations (0, 2.5, 5 and 10 mg/mL) and varied mechanical indexes (0.5, 0.6 and 0.7), and their corresponding quantitative grey values (b).



Figure S2. (a) *In vivo* ultrasound imaging of tumors before and after *in-situ* administration of saline (a_1 : before and a_2 : after injection) and MnOx-HMCNs saline solution (a_3 : before and a_4 : after injection), and the corresponding changes of gray values (b).

Discussion. *In vitro* assay (**Figure S1**) shows that MnOx-HMCNs can generate the significant contrast enhancement in US imaging, which is also concentration- and mechanical index-dependent. *In vivo* US imaging of tumor also exhibits the US signal increase after the introduction of MnOx-HMCNs (**Figure S2**). The unique contrast-enhanced US imaging performance of MnOx-HMCNs can be attributed to the hollow core/shell nanostructures, which is similar to the reports about the effects on the US imaging of hollow silica nanoparticles^[1] and hollow mesoporous silica nanoparticles.^[2]



Figure S3. Optical microscopic image of wound-healing assay of MDA-MB-231 cancer cells just after the generation of wounded area.



Figure S4. A series of CLSM images of MCF-7/ADR cancer cells along the Z-axis after the co-incubation with Dox/MnOx-HMCNs for 8 h. The simultaneous occurrence and disappearance of red Dox fluorescence and blue nuclei DAPI fluorescence demonstrate that Dox/MnOx-HMCNs were indeed endocytosized into cancer cells but not present on the surface of cells.



Figure S5. Optical microscopic images of main organs (heart, liver, spleen, lung and kidney) of MnOx-HMCNs-treated healthy nude mice after histological hexatoxylin eosin (HE) staining. The mice were intravenously received MnOx-HMCNs saline solution with different doses (12.5, 25 and 50 mg/kg), and feed for 15 days.

Part B. References

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