Supporting Information

Ultrafast Synthesis of Multifunctional Submicrometer Hollow Silica Spheres in Microfluidic Spiral Channels

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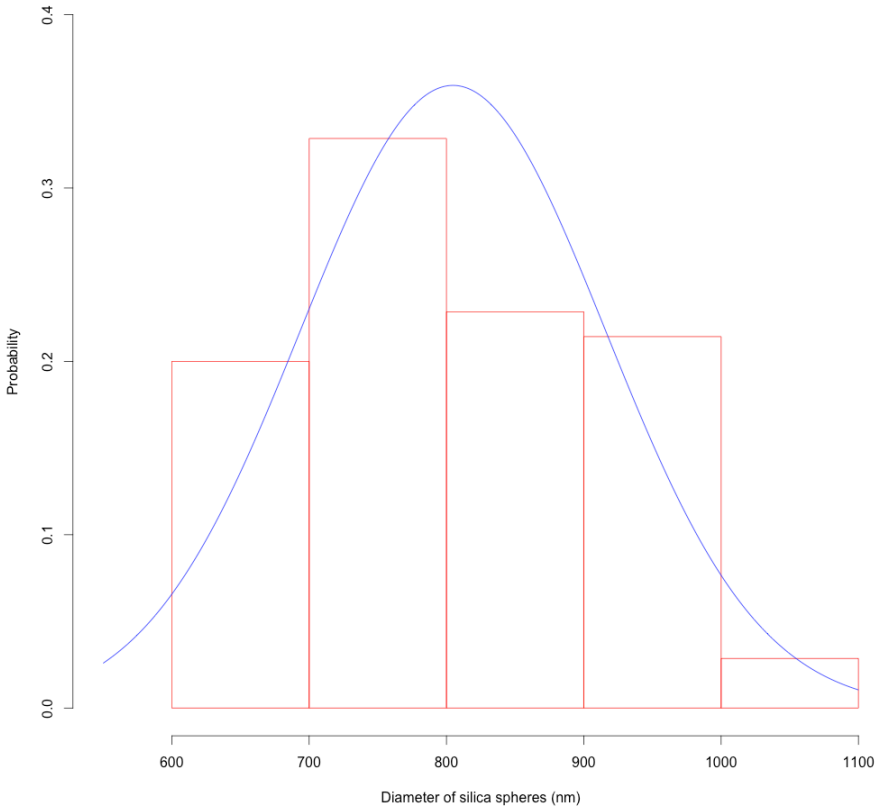

Figure S1. Statistical size distribution of as-synthesized smHSSs, the average diameter of silica spheres is 804.7 nm, and the standard deviation is 111.1 nm (13.8%).

Table S1. Mixing of two reactant solutions with different chemical compositions, concentrations and flow rates for the synthesis of smHSSs. Results for test (1) – (3): no desired smHSSs synthesized; result for test (4): smHSSs synthesized.

Solution II (Inlet 2) / **Solution I (Inlet 1)**	**80 µl TEOS in Ethanol**
Diluted ammonia water	(1) 5 µL/min
	(2) 10 µL/min
CTAB in diluted Ammonia water	(3) 5 µL/min
	(4) 10 µL/min

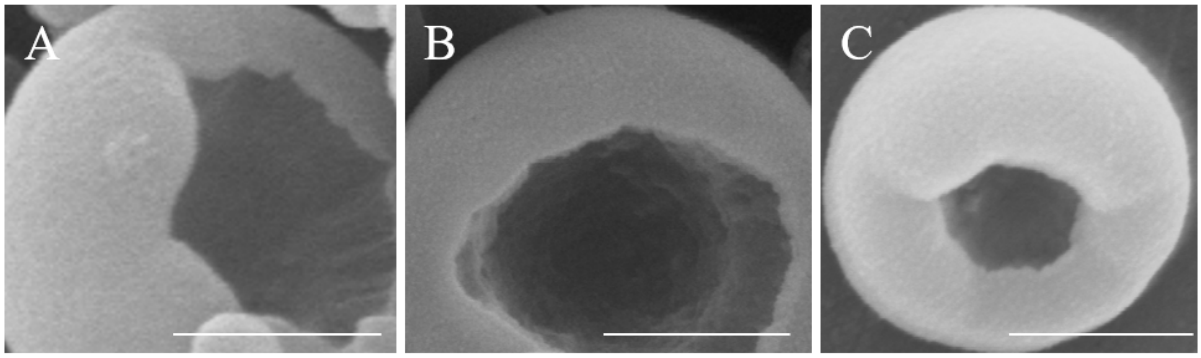

Figure S2. smHSSs synthesized with ammonia water of (A) 0.5 mL, (B)1.5 mL, and (C) 3 mL, scale bars are 500 nm.

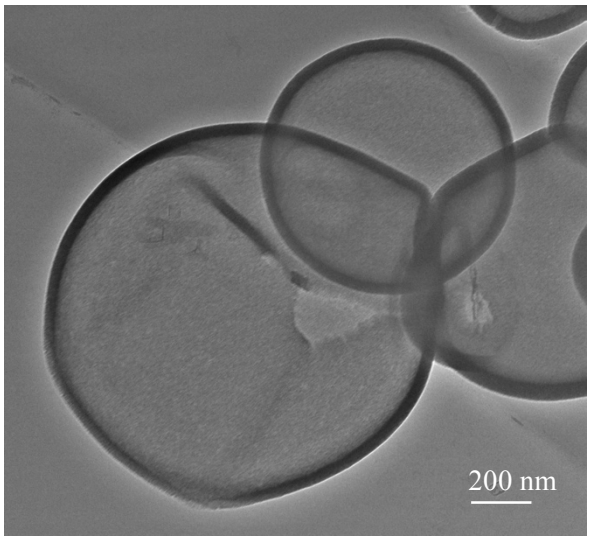

Figure S3. Transmission Electron Microscopy (TEM) image of smHSSs synthesized in two-run spiral microchannel.

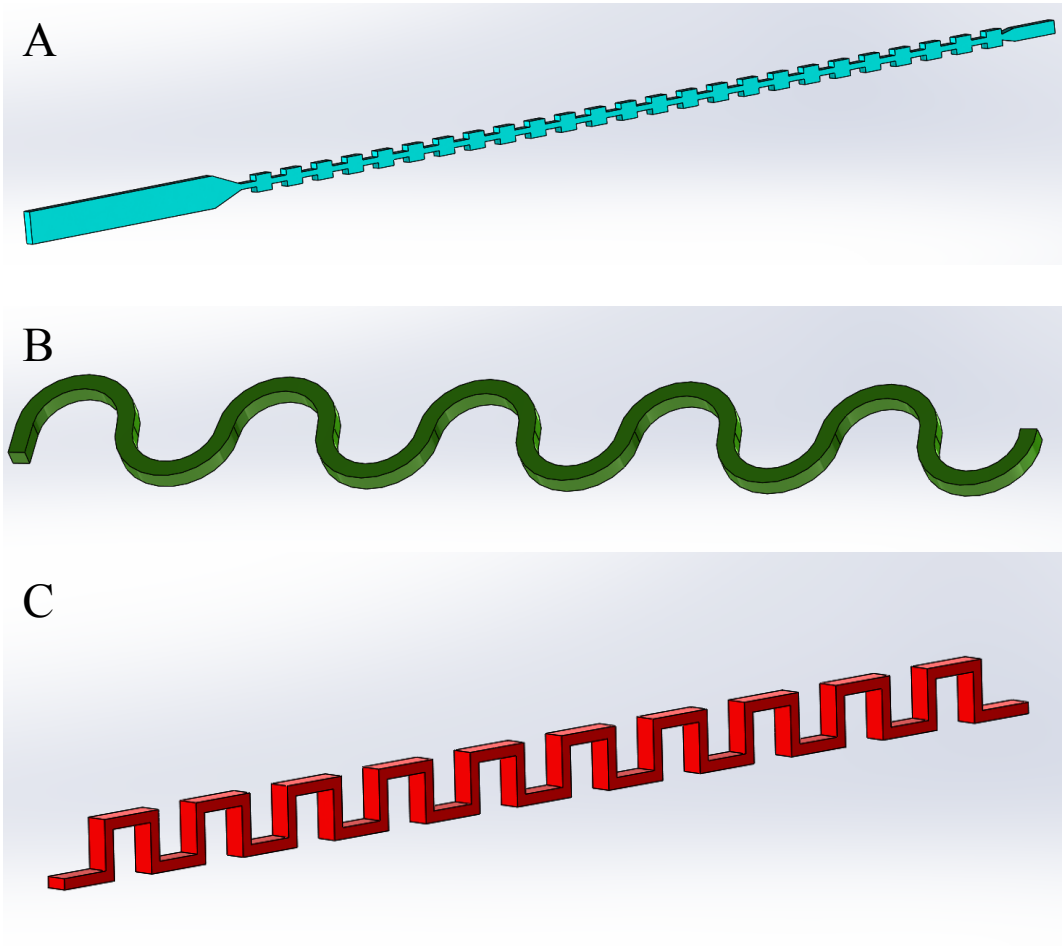

Figure S4. Schematic images of different channel designs: A. expansion and contraction channel; B. circular serpentine channel; and C. rectangular serpentine channel.

Table S2. Setup of synthesis tests with different microfluidic channel designs

Micro channels	Channel width (μm)	Flow rate	Chemical solutions
Spiral	500	400 μL/min	Solution I: Ammonia water + CTAB Solution II: 80 μL TEOS in ethanol
Expansion and contraction	Expansion region: 90 Pinched region: 30		
Circular serpentine	200		
Rectangular serpentine	100		

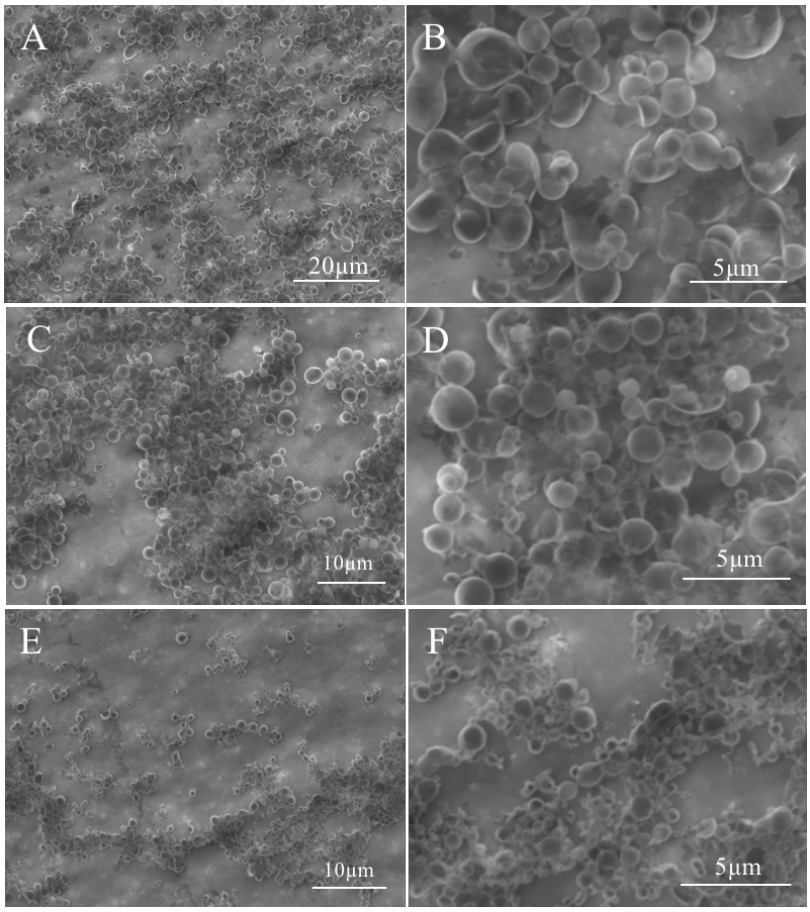

Figure S5. Scanning Electron Microscopy (SEM) images of smHSSs synthesized in expansion and contraction channel (A and B), circular serpentine channel (C and D), and rectangular serpentine channel (E and F).

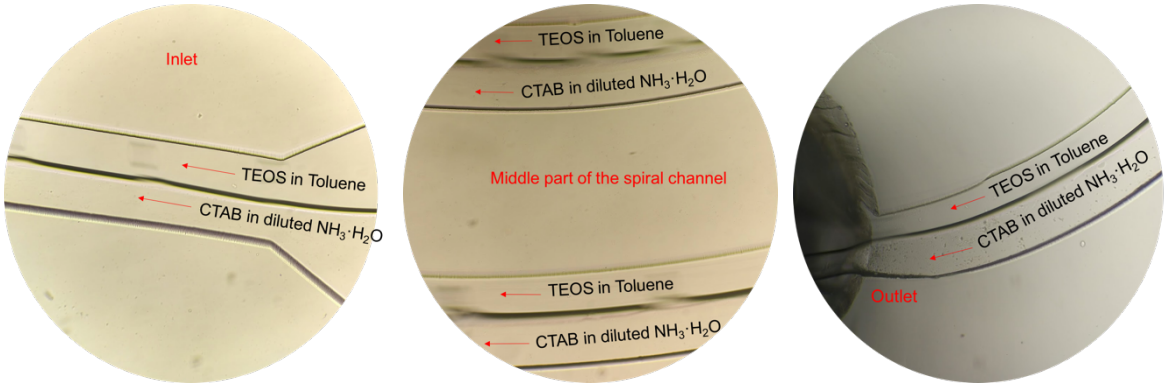

Figure S6. Mixing of TEOS in Toluene and CTAB in diluted ammonia water.

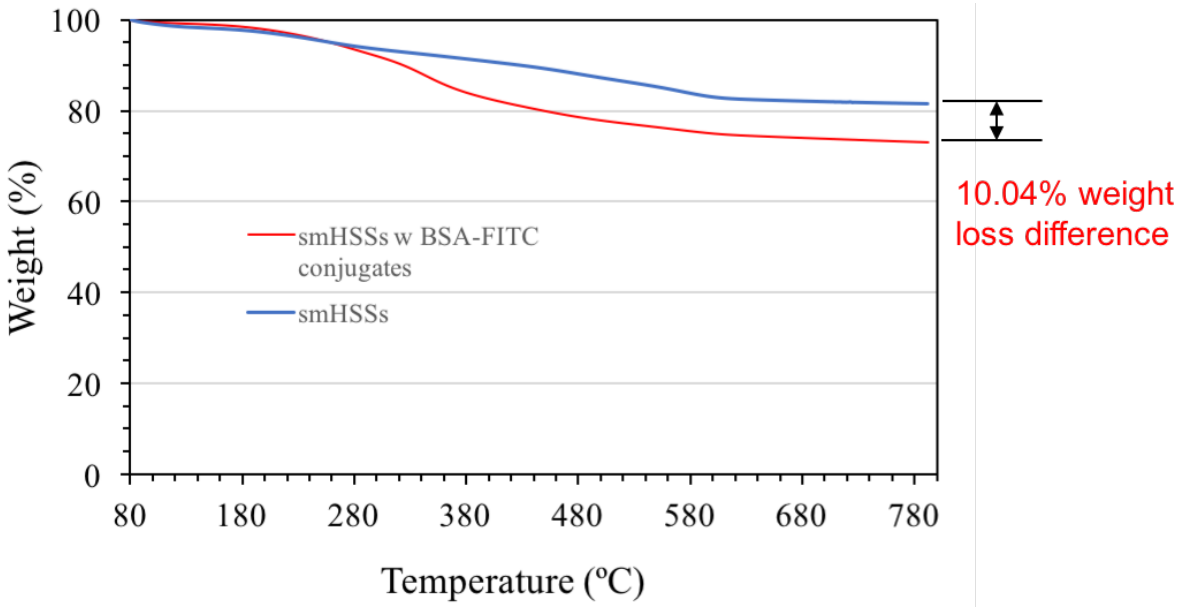

Figure S7. Thermogravimetric analysis (TGA) of smHSSs loaded with BSA-FITC conjugates and smHSSs.

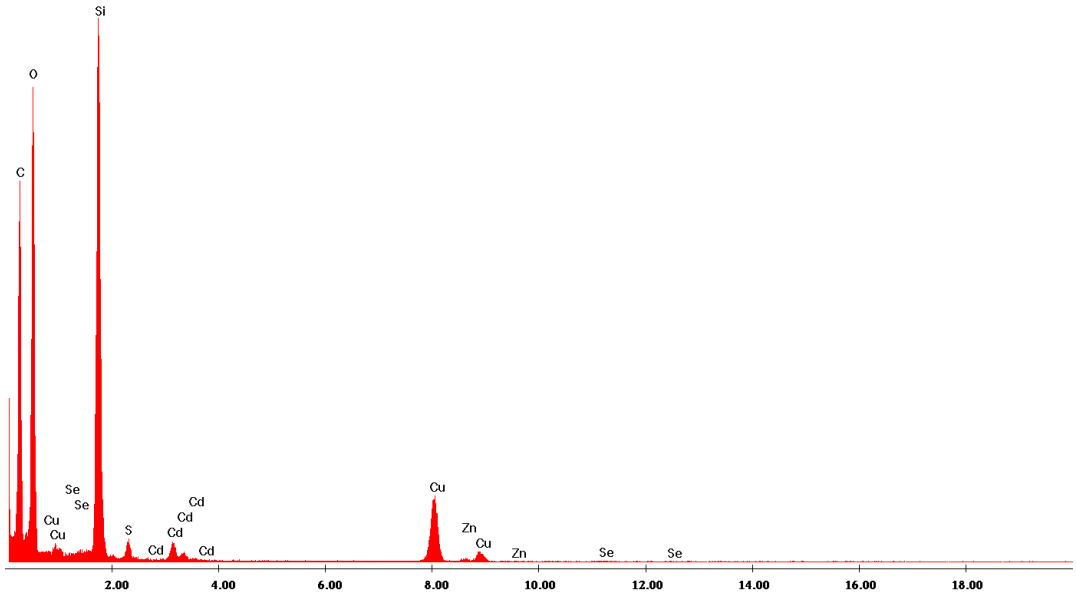

Figure S8. Energy-dispersive X-ray spectroscopy (EDS) analysis of multifunctional smHSSs loaded with quantum dots.

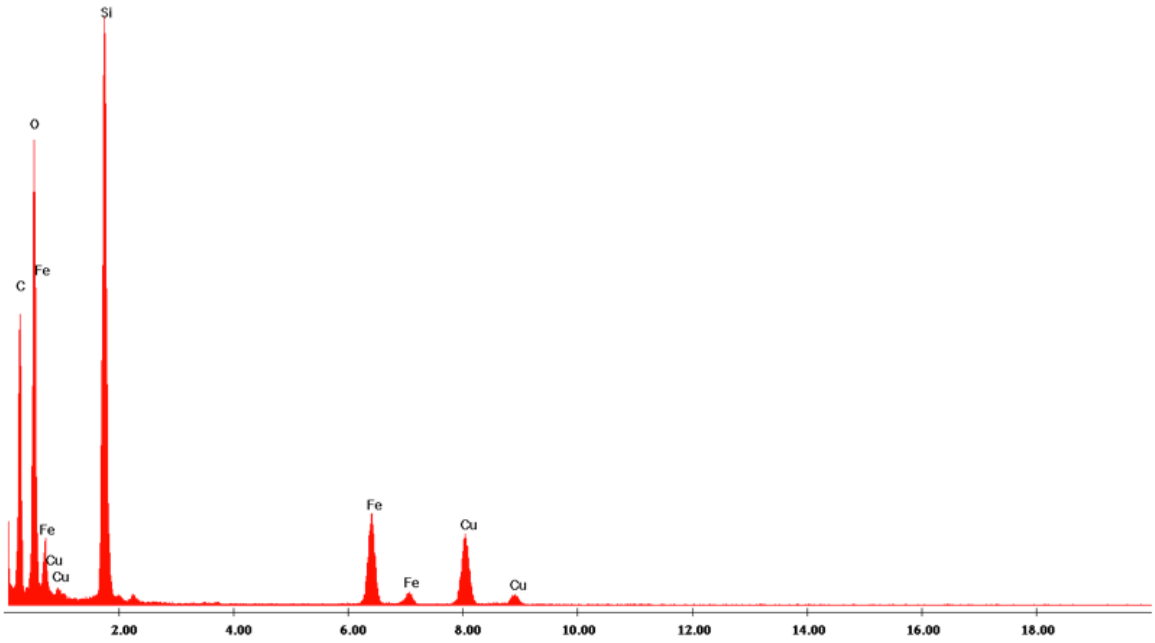

Figure S9. Energy-dispersive X-ray spectroscopy (EDS) analysis of multifunctional smHSSs loaded with magnetic nanoparticles.