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**Organosilane-assisted selective etching strategy for fabrication of hollow/rattle-type mesoporous organosilica nanospheres**Yu Wang<sup>a1</sup>, Pengpeng Wang<sup>a1</sup>, Lianxi Chen<sup>a\*</sup>, Jie Li<sup>b</sup>, Zhenhui Liu<sup>c</sup><sup>a</sup>School of Chemistry, Chemical Engineer and Life Science, Wuhan University of Technology, Wuhan, 430070, P. R. China.<sup>b</sup>School of food and environmental engineering, Wuchang Institute of Technology, Wuhan, 430065, P. R. China<sup>c</sup>School of Materials Science and Engineering, Wuhan University of Technology, Wuhan, 430070, P. R. China

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**Abstract:**

A facile strategy to fabricate hollow or rattle-type mesoporous silica nanospheres (HMSNs or RMSNs) with organic functional groups and porous shell was developed. Herein, thiol-HMSNs were obtained via treating vinyl-SiO<sub>1.5</sub>@cyano&thiol-SiO<sub>1.5</sub> prepared by using 3-mercaptopropyltrimethoxysilane (MPTMS) as organosilane precursor, vinyltriethoxysilane (VTES) as sacrificial template precursor and cyanoethyltriethoxysilane (CTES) as pore-making agent. In this method, CTES was co-condensed with MPTMS to form hybrid shell and played an important role in the formation of pore structures. When the volume ratio of MPTMS to CTES was 1:1, well-defined thiol-HMSNs with a specific surface area of 295.6 m<sup>2</sup>·g<sup>-1</sup> and pore volume of 0.51 cm<sup>3</sup>·g<sup>-1</sup> could be obtained. Moreover, thiocyanato@thiol-RMSNs could also be synthesized through this method from three-layered structures (thiocyanato-SiO<sub>1.5</sub>@vinyl-SiO<sub>1.5</sub>@cyano&thiol-SiO<sub>1.5</sub>). The as-prepared RMSNs presented good performance for the adsorption of 2, 4-dichloropheno in water. And this selective etching strategy was versatile and might be extended to fabricate more valuable organic hollow/rattle-type composites for different applications.

**Graphical abstract**

HMSNs and RMSNs with organic functional groups and porous shell were fabricated based on a facile organosilica-assisted selective etching strategy. VTES and CTES were adopted as sacrificial template and pore-making agent, respectively. Both of them can be removed after alkali treatment, and hollow and mesoporous structure was further achieved synchronously.

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