Supplementary Information for

Three-dimensional $MgSiO_3$-coated SnO_2/C nanostructures for efficient adsorption of heavy metal ions from aqueous solution

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Preparation of $MgSiO_3$ spheres: it contains two steps: 1) preparation of SiO_2 sphere template; 2) hydrothermal synthesis of $MgSiO_3$ on the basis of templates.

1) SiO_2 spheres as templates were prepared through a Stöber method. Typically, 8 mL of de-ionized water and 2 mL of ammonium hydroxide were mixed with 40 mL of ethanol. Then, 0.6 mL of tetraethylorthosilicate (TEOS) (Sigma-Aldrich Corp.) was added dropwise into the solution under constant stirring. After 2 h, the white precipitation was collected using centrifuge, and washed thoroughly with ethanol and deionized water. In order to increase the size of SiO_2, the obtained precipitation was re-dispersed into the starting solution of ammonium hydroxide, ethanol and water; then repeat with adding TEOS and following steps. The obtained SiO_2 spheres were dried at 60 ℃ in an oven for further use.

2) The procedures for $MgSiO_3$ growth are similar to the synthesis using SnO_2/C templates with some modifications (the increased temperature and extended time ensure the removal of SiO_2 templates under basic environment). In a typical procedure, 0.1 g of $Mg(NO_3)_2 \cdot 6H_2O$, 0.2 g of NH_4Cl and 0.8 mL of concentrated ammonia solution were added into 30 ml of DI water under stirring. Then 0.1 g of the SiO_2 spheres was dispersed into the solution. The solution was transferred into a 50 mL Teflon-lined steel autoclave. The autoclave was sealed, heated at 160 ℃ for 12 h and allowed to cool naturally to room temperature. The sample was collected, washed thoroughly with ethanol and deionized water, and was dried at 60 ℃.

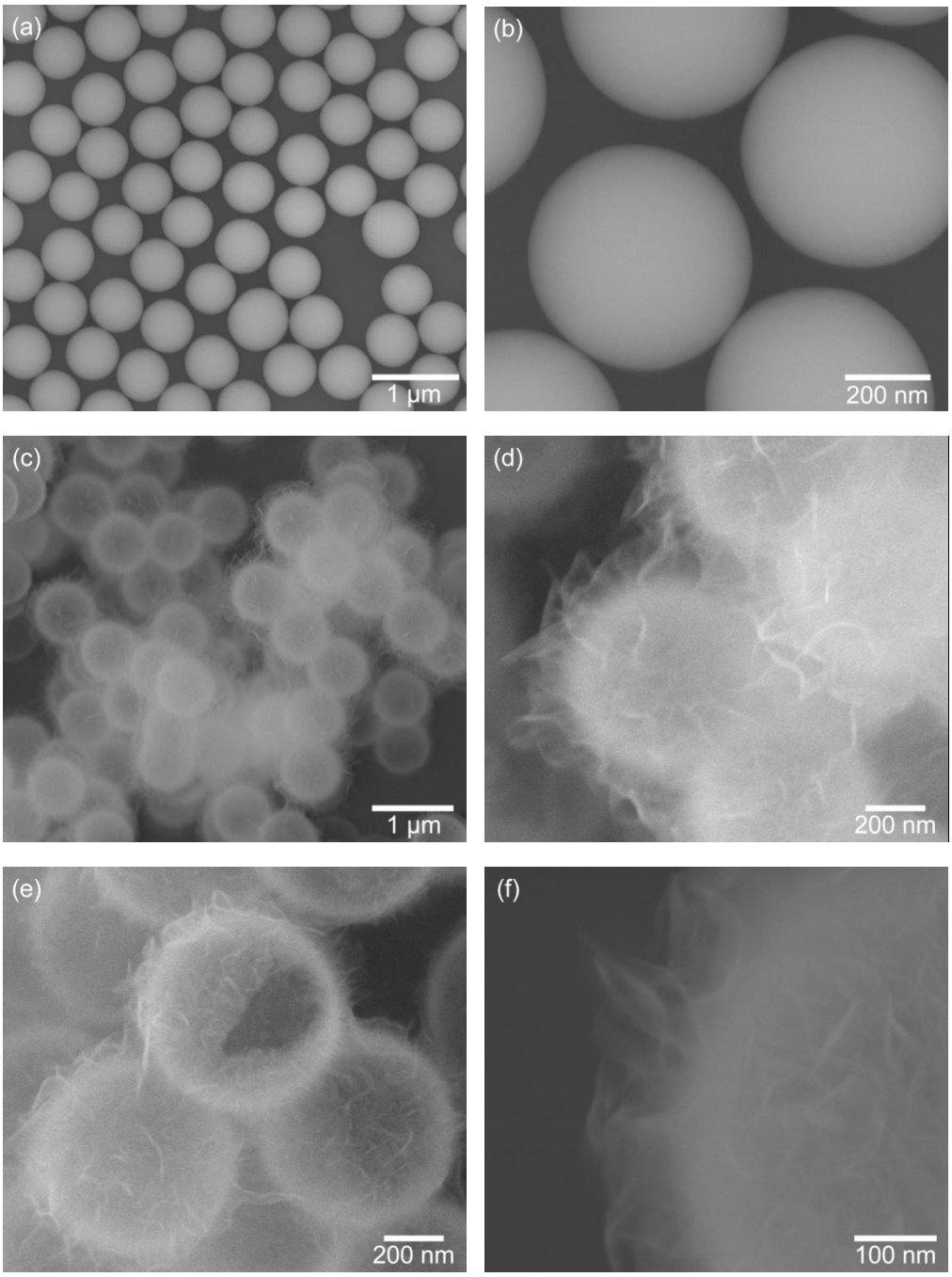

Fig. S1. SEM images of (a), (b) the prepared SiO_2 spheres using as templates, and (c)-(f) $MgSiO_3$ nanospheres obtained through hydrothermal synthesis. In (e), the hollow structure of these spheres is confirmed.

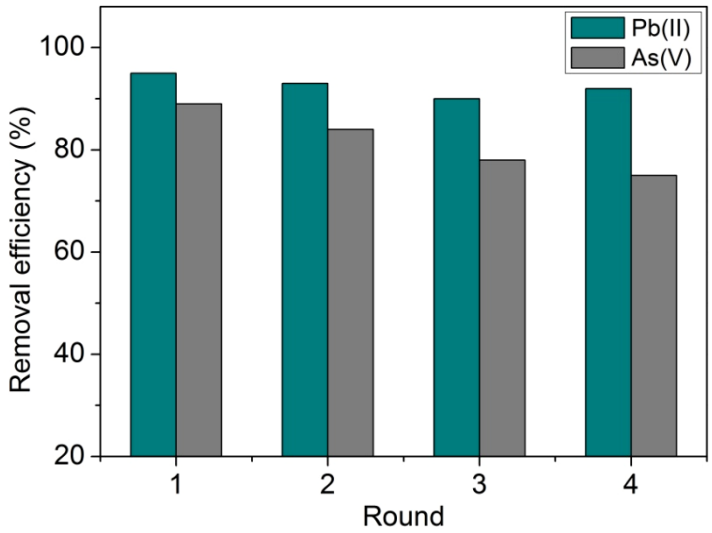

Fig. S2. Recycling of the $MgSiO_3$-coated SnO_2/C adsorbents using NaOH/Mg^{2+} solution as the desorbing solution. 1) Adsorption conditions: $C_{initial}$, 10 mg L^{-1}; adsorbent dose, 20 mg into 30 mL target solution; adsorption time, 4 h; room temperature. 2) Desorption conditions: regeneration solution, 0.5 M NaOH and 10 mg L^{-1} Mg^{2+} in DI water; desorption time, 2 h; room temperature; collected by centrifuge, and washed with water and ethanol.