Electronic Supplementary Material (ESI) for Chemical Communications

Supporting Information

Silicon-Doped Hematite Nanosheets with Superlattice Structure

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Experimental details:

Synthesis of Si-doped α-Fe_2O_3 nanosheets: The synthesis processes are illustrated schematically in Scheme 1. An Si target (99.999%) was immersed in deionized water and ablated for 30 min using the fundamental (1064 nm) Nd:YAG pulsed laser with 10 ns pulse duration and 70 mJ pulse energy. The mixture of Si colloids and 5 mM $FeCl_3$ aqueous solution was then transferred to a Teflon container, which was then heated in a steel autoclave for 12 h at 180 °C. After the reaction, the brick-red Si-doped α-Fe_2O_3 colloidal suspensions were centrifuged to obtain the powder products for further characterization.

Structural characterization: A transmission electron microscope (H-800; Hitachi, Japan) and a field emission scanning electron microscope (Sirion 200 FEG) were used to investigate the morphology and structure of the Si-doped α-Fe_2O_3. The UV-vis spectra of the obtained samples were recorded by a Cary 5E UV-vis-NIR spectrophotometer. The XRD analysis of the collected products was performed using a Philips X'Pert system with Cu Kα radiation (λ = 1.5419 Å, scanning rate of 1.0°/min).

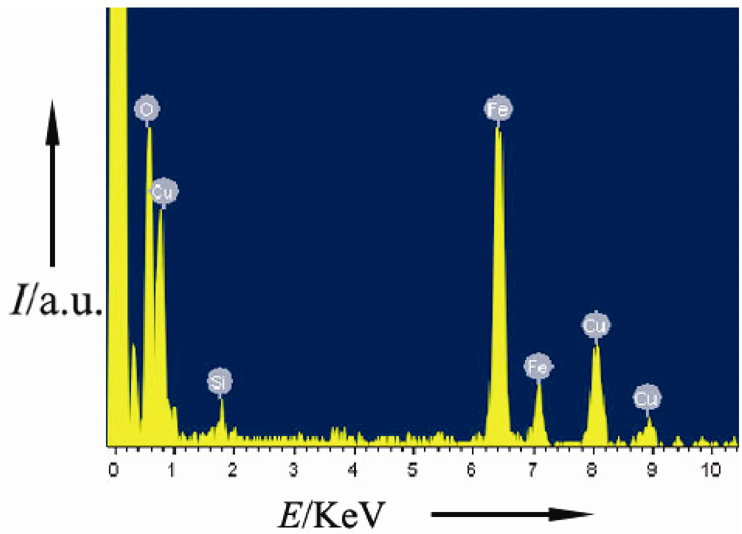

Figure S1. EDS spectrum of silicon doped α-Fe_2O_3 nanosheets

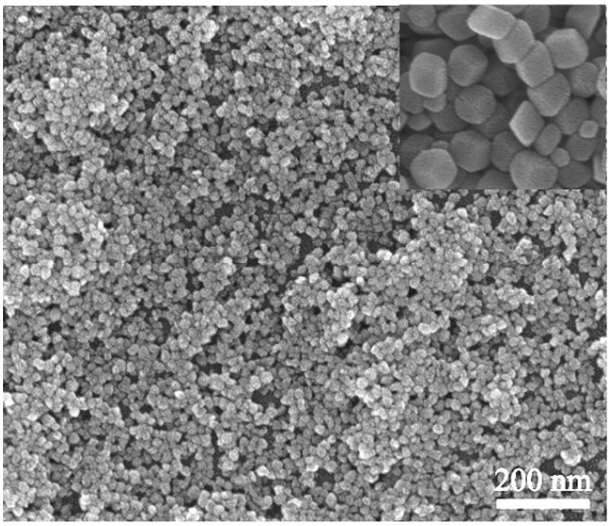

Figure S2. SEM images of pure α-Fe_2O_3

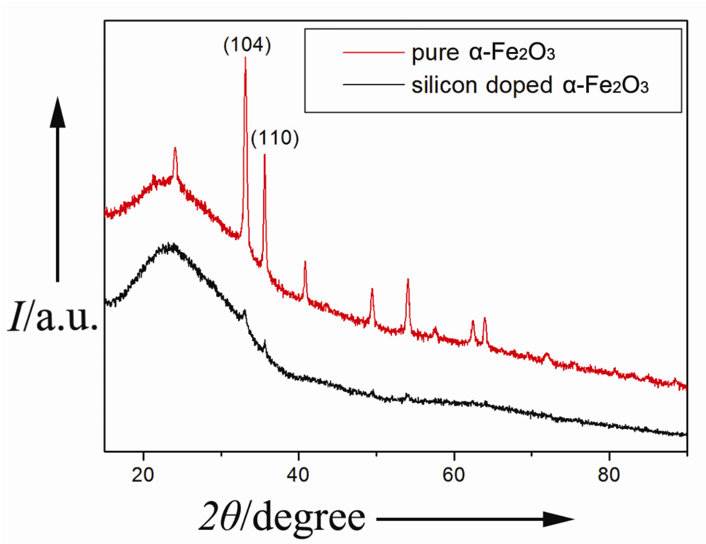

Figure S3. XRD patterns of pure α-Fe_2O_3 and Si-doped α-Fe_2O_3

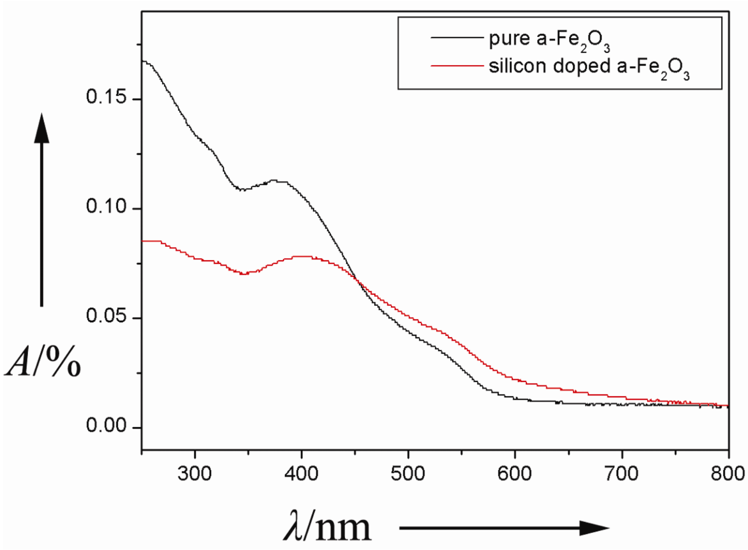

Figure S4. UV-vis spectra of pure α-Fe_2O_3 and Si-doped α-Fe_2O_3 dispersed in water

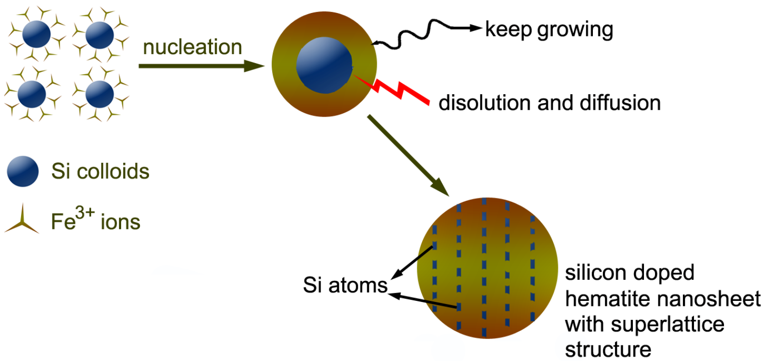

Figure S5. Schematic illustration of the possible growth procedure of Si-doped hematite under hydrothermal treatment

The LAL induced Si clusters are highly reactive, which could be served as the growth seeds as used widely in hydrothermal synthesis of nanocrystals. Here, initially, the Fe^{3+} ions could be aggregated around Si clusters. Then the reactive Si clusters play roles in heterogeneous nucleation of hematite and affect the growth orientation under hydrothermal condition. Simultaneously, the Si cluster will dissolute into Si^{4+} ions and diffuse inside hematite lattice during the on-going growth of hematite nanosheet. The possible formation mechanism may be briefly illustrated as Figure S5.