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# MOF-derived porous hollow $\alpha$ -Fe<sub>2</sub>O<sub>3</sub> microboxes modified by silver nanoclusters for enhanced pseudocapacitive storage

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## Abstract

Porous hollow  $\alpha$ -Fe<sub>2</sub>O<sub>3</sub> microboxes with high surface area are prepared by using metal-organic framework as precursor and self-template. To improve the conductivity of the derived  $\alpha$ -Fe<sub>2</sub>O<sub>3</sub> microboxes and thus enhance their capacitive storage and rate capability as effective electrode material, especially as anode material for supercapacitors, Ag nanoclusters are uniformly deposited on the surface of the  $\alpha$ -Fe<sub>2</sub>O<sub>3</sub> microboxes ( $\alpha$ -Fe<sub>2</sub>O<sub>3</sub>@Ag microboxes) through a facile solution method. As pseudocapacitive material, the  $\alpha$ -Fe<sub>2</sub>O<sub>3</sub>@Ag microbox electrode displays a high specific capacitance of 701 F g<sup>-1</sup> at a current density of 0.1 A g<sup>-1</sup>, and remains 191 F g<sup>-1</sup> at a high current density of 10 A g<sup>-1</sup>. Furthermore, the material shows 80% specific capacitance retention after 2,000 charge-discharge cycles, and 72% retention after 10,000 cycles at a current density of 10 A g<sup>-1</sup>. In addition, asymmetric supercapacitors are assembled with the  $\alpha$ -Fe<sub>2</sub>O<sub>3</sub>@Ag as negative electrodes and commercial activated carbon as positive electrodes. A maximum specific capacitance of 123 F g<sup>-1</sup> and an energy density of 41.8 Wh Kg<sup>-1</sup> are demonstrated within a cell voltage of 1.6 V for the device.

**Keywords:** Fe<sub>2</sub>O<sub>3</sub> microboxes; Ag nanoclusters; metal-organic framework; supercapacitor

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