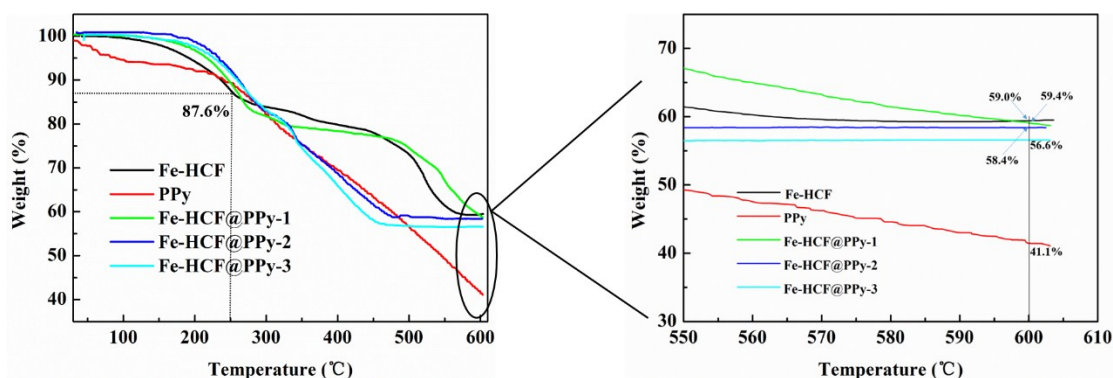# Supporting information

Fig. S1 TG curves of Fe-HCF, PPy and Fe-HCF@PPy.

In Fig. S1, the weight loss of 12.4% in Fe-HCF below 250 °C is mainly attributed to the absorbed water and zeolitic water.

The PPy contents can be roughly calculated by the formula of $(1 - x) \cdot L_{Fe-HCF} + x \cdot L_{PPy} = L_{Fe-HCF@PPy}$, in which x is the percentage of PPy content in Fe-HCF@PPy, while L_{PPy}, $L_{Fe\text{-}HCF}$ and $L_{Fe\text{-}HCF@PPy}$ represent the percentage of weight loss at 600 °C. According to the TG results, the PPy contents in Fe-HCF@PPy-1, Fe-HCF@PPy-2 and Fe-HCF@PPy-3 are calculated as 2.2%, 5.6% and 15.6%, respectively. It is noted that the crossover of TG curves between Fe-HCF and Fe-HCF@PPy-1 can be ascribed to the small amount of PPy in Fe-HCF@PPy-1 and the slightly larger water content in Fe-HCF.
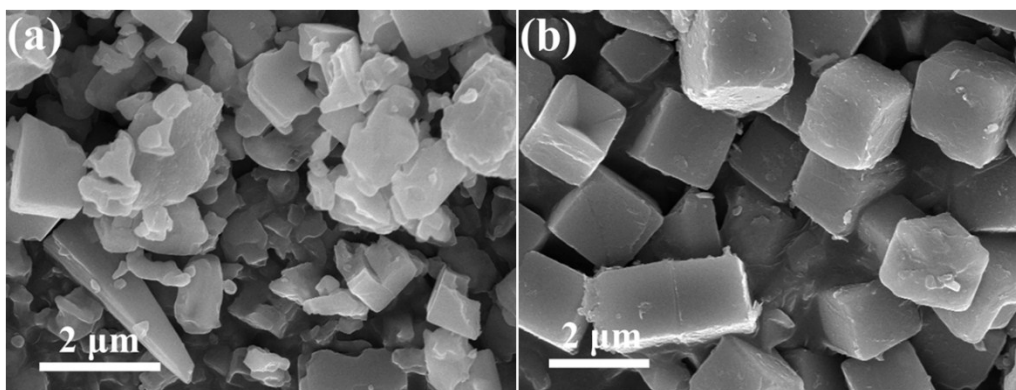

Fig. S2 SEM images of (a) Fe-HCF and (b) Fe-HCF@PPy-2 after etching in the 1M HCl solution at 140 °C for 4 h.
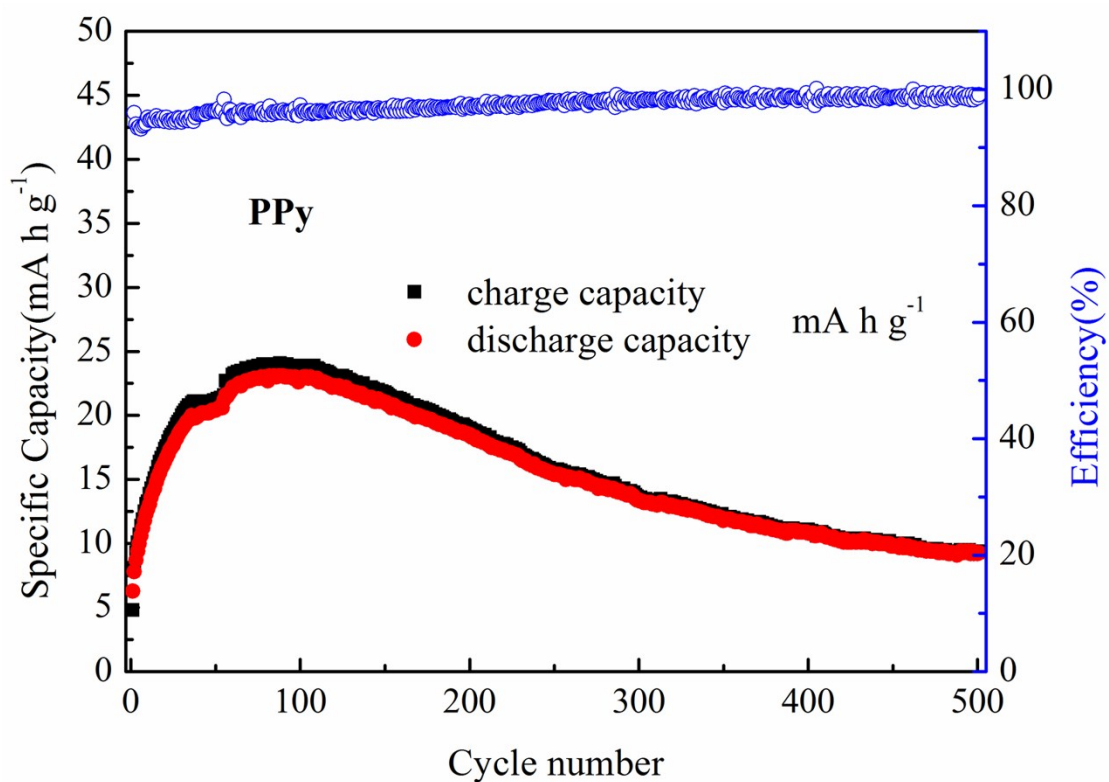
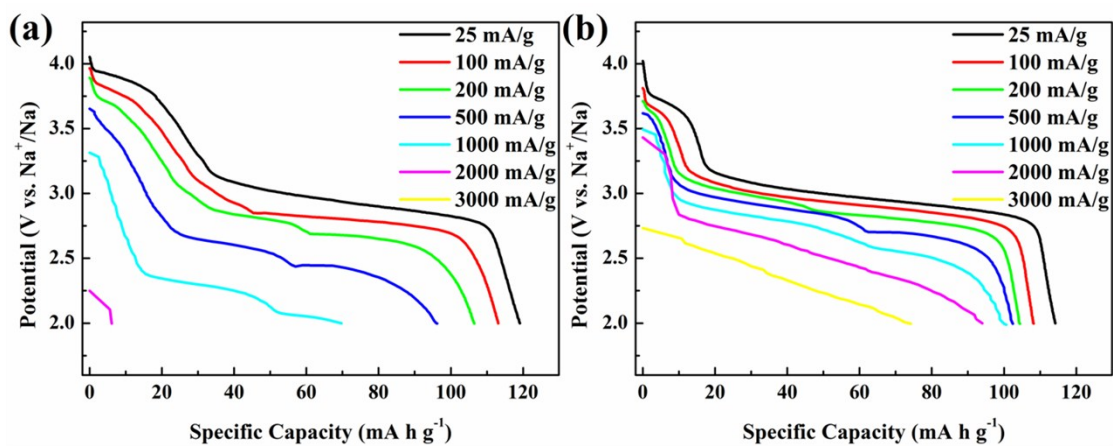**Fig. S3** Long-term cycling stability of PPy at constant currents of 50 mA g^{-1}.

Fig. S4 Discharge profiles of (a) Fe-HCF and (b) Fe-HCF@PPy-2 electrodes at different rates.
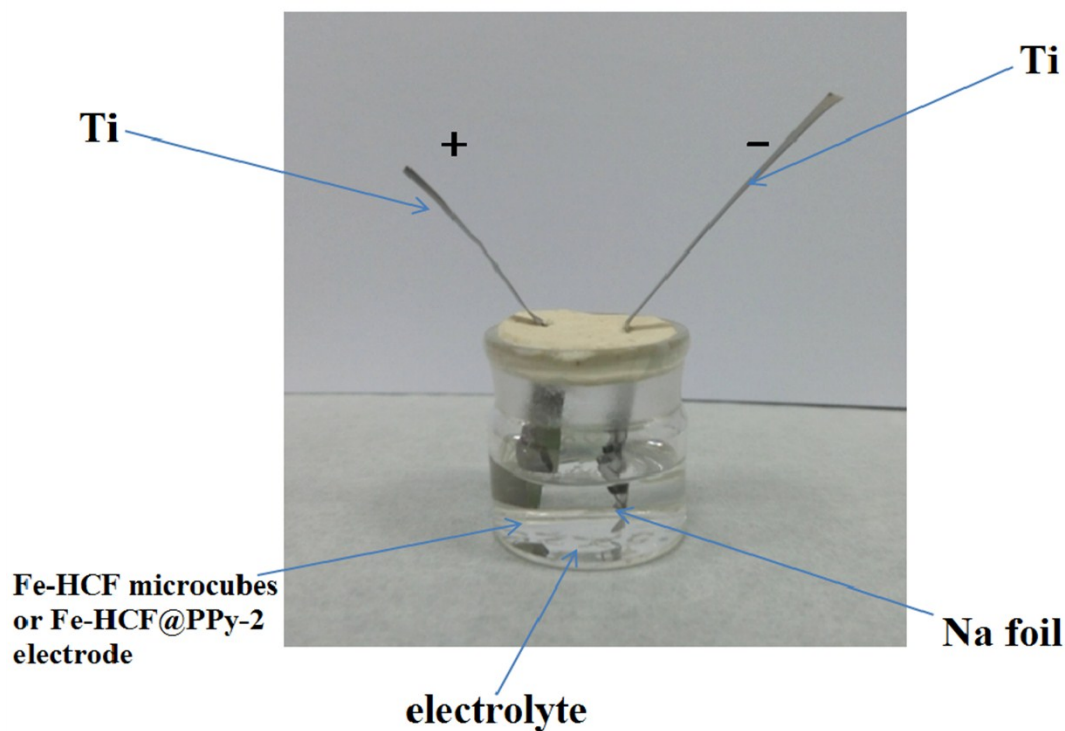
Fig. S5 Photo image of the homemade half-cell that was assembled and tested in an Ar-filled glovebox.

The homemade half-cell was assembled in an Ar-filled glovebox by using the Fe-HCF or Fe-HCF@PPy-2 electrode as working electrode, metallic-sodium as counter electrode, titanium sheet as current collector, and 1 mol L^{-1} $NaClO_4$ in EC/PC (1:1 by volume) as electrolyte. The working electrode was totally immersed in the electrolyte and the amounts of electrolyte solution were kept at 5 times of active material in mass. After 200 galvanostatic charge-discharge cycles at a current density of 200 mA g^{-1} in the glovebox, the content of element Fe in the electrolyte solution was analyzed by inductively coupled plasma emission spectrometer (ICP-OES).