Supplementary Information

Advanced porous membranes with ultra-high selectivity and stability for Vanadium flow battery

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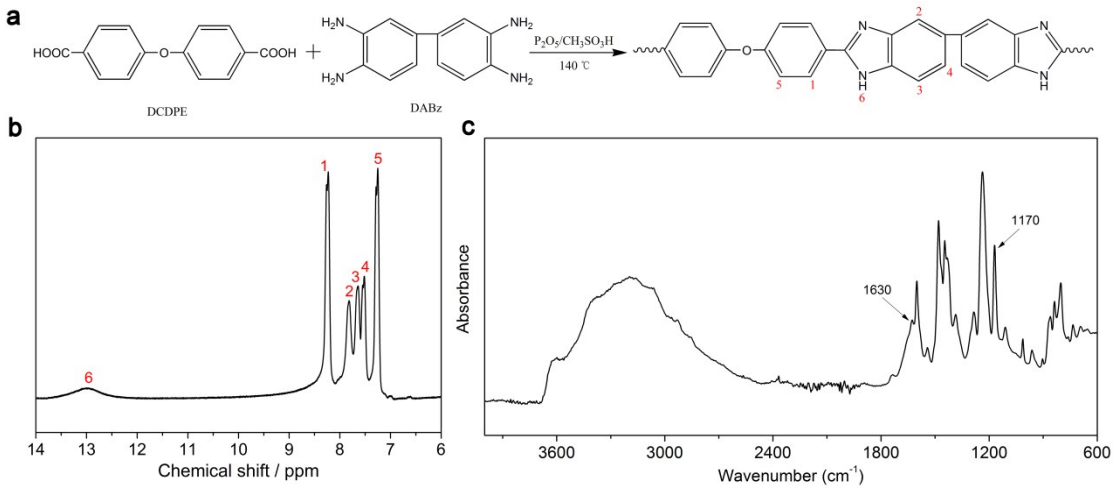
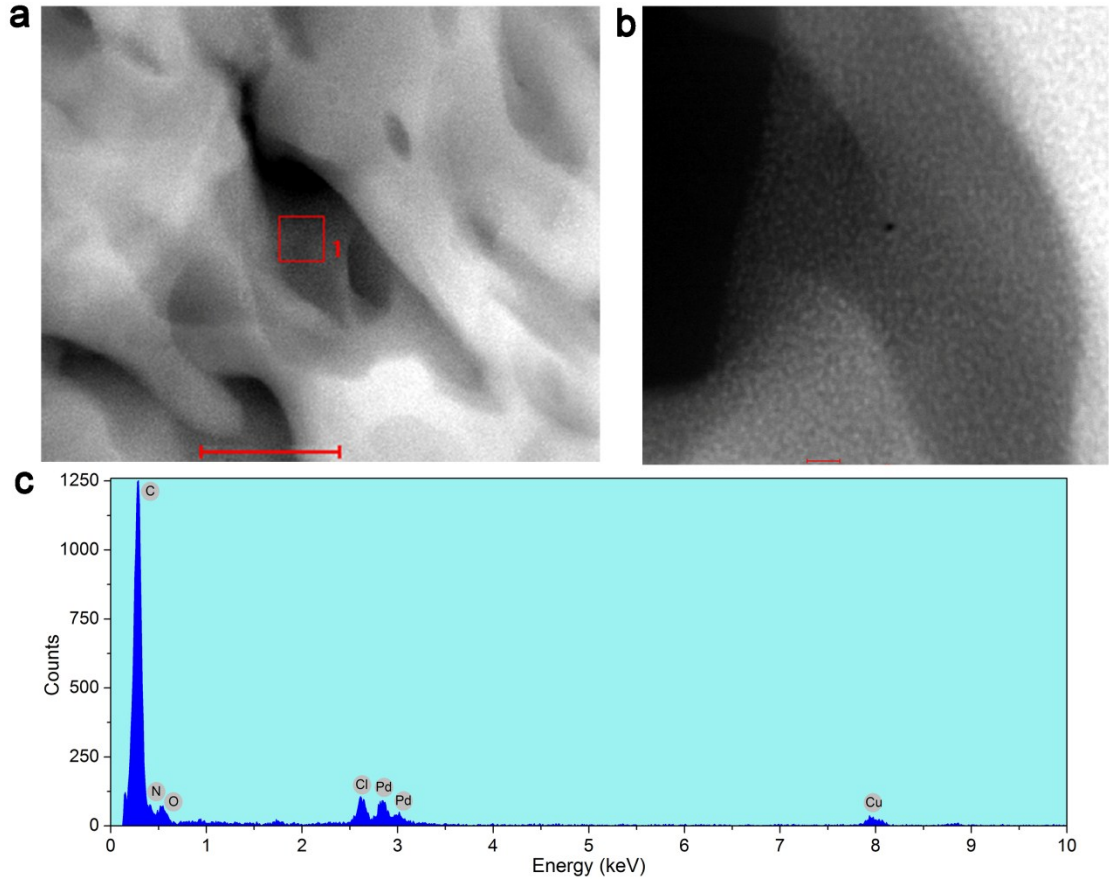
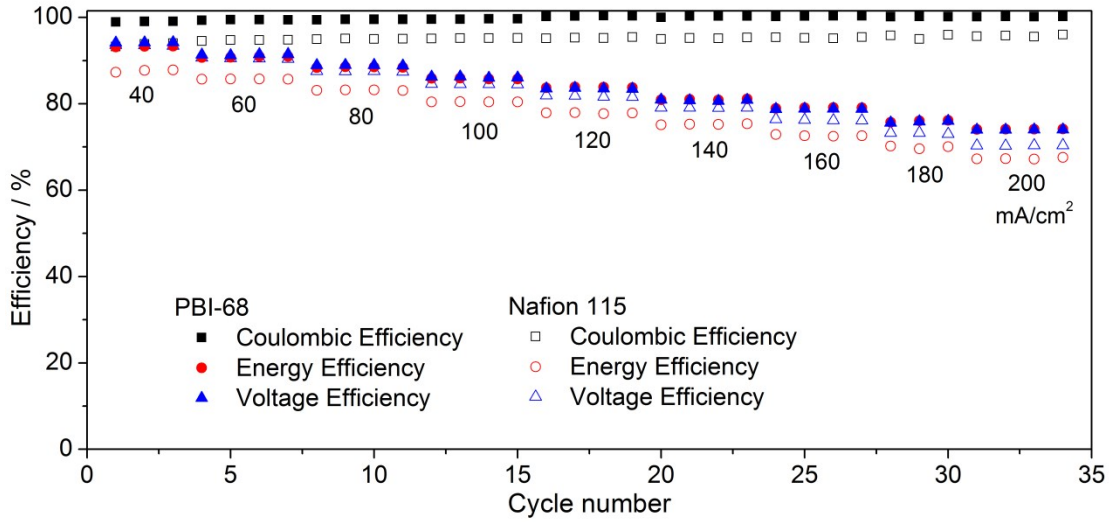


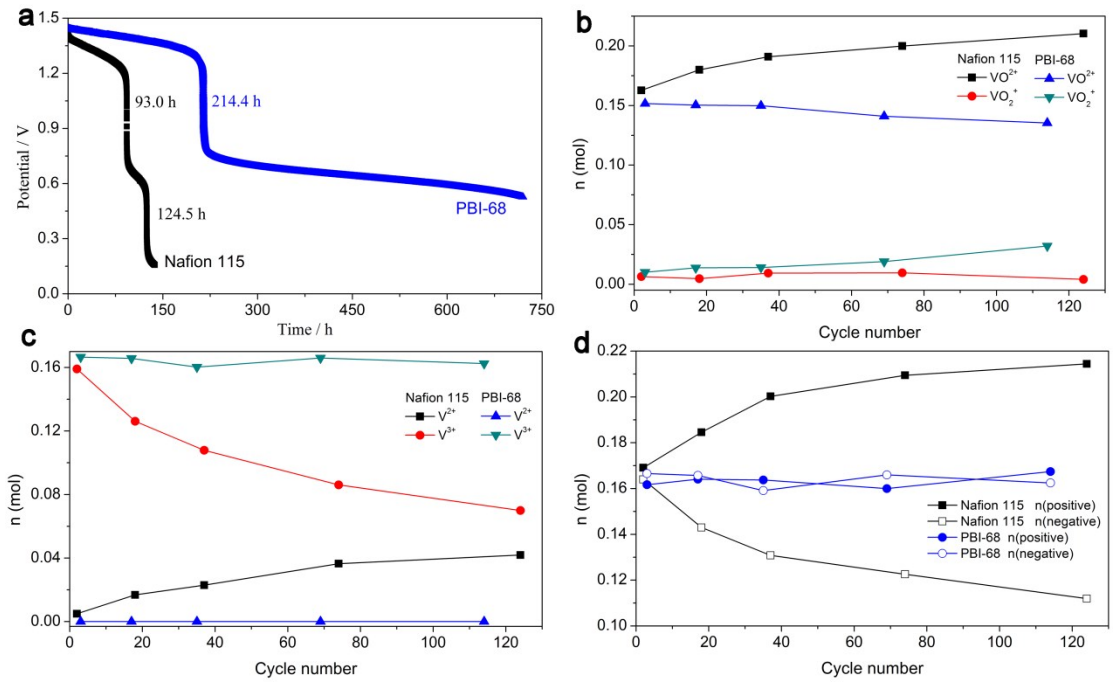
Supplementary Fig. S1 Polybenzimidazole (PBI) polymer synthesis and characterization. a, the synthesis of PBI. b, the ^{1}H NMRspectra of PBI. c, the FTIR spectra of PBI.



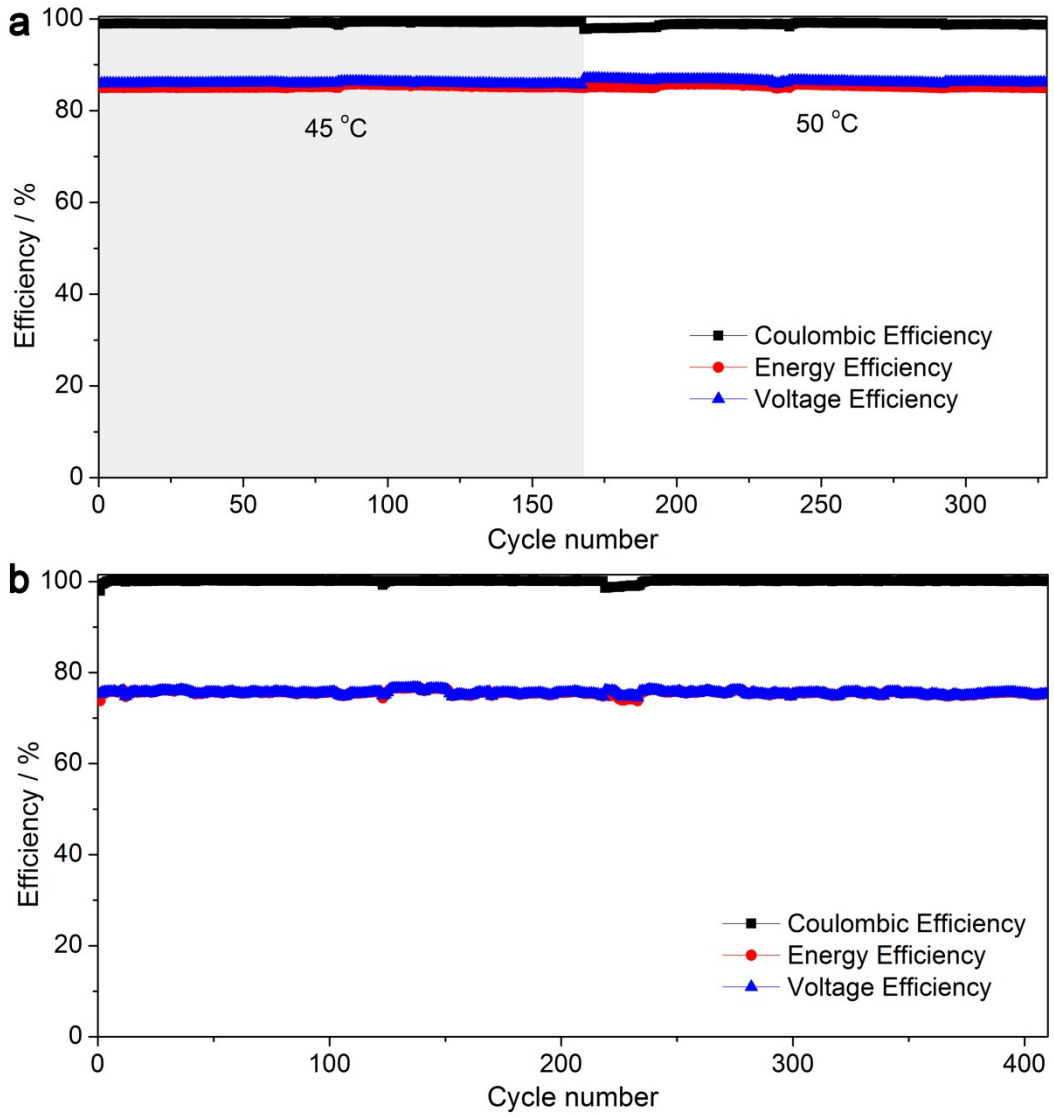
Supplementary Fig. S2 The morphology of PBI-68 and the distribution of positively charged nitrogenin it. a, HR-STEM image of PBI-68; scale bar, 200 nm. b, magnified HR-STEM image of PBI-68; scale bar, 10 nm. c, Corresponding EDS spectra of the marked area in panel a.



Supplementary Fig. S3 The cycling performance of a vanadium flow battery using PBI-68 and Nafion 115 with current densities ranging from 40 to 200 mA/cm^2.



Supplementary Fig. S4 Vanadium transfer behavior of prepared PBI porous membranes and Nafion 115 membrane. a, Open circuit voltage of the VFB assembled with PBI-68 and Nafion 115 membranes. b, Change of VO^{2+} and VO_2^+ in the positive half cells when employing PBI-68 or Nafion 115 as a membrane during the cycling test. c, Change of V^{2+} and V^{3+} in the negative half cells when employing PBI-68 or Nafion 115 as a membrane during the cycling test. d, Molar quantity of total vanadium ions in the positive and negative half cells when employing PBI-68 or Nafion 115 as a membrane during the cycling test.



Supplementary Fig. S5 Electrochemical stability of PBI-68 porous membrane. a, outstanding cycling stability of PBI-68 at high temperatures (45°C and 50 °C; current density, 120 mA/cm^2). b, cycling performance of PBI-68 at high current density (180 mA/cm^2).