Supplementary Information

I. Maximum power density calculation

Maximum power density calculation of PANI Films are calculated from the galvanostatic charge/discharge curves at different current densities using the following formulas:

\[ P = \frac{(\Delta V)^2}{4mR_{es}} \]  \hspace{1cm} (S1)

\[ R_{es} = \frac{IR_{drop}}{2I} \]  \hspace{1cm} (S2)

where \( I \) is charge or discharge current, \( \Delta t \) is discharge time, \( \Delta V \) is potential window (0.8 V), \( IR_{drop} \) is potential drop, \( m \) is mass of PANI films, \( R_{es} \) is the internal resistance of the electrode that is estimated from the potential drop \( (IR_{drop}) \) at the beginning of the discharge curve.
II. Supplemental Figures

Fig. S1. FT-IR spectra of PANI-EB films after electrochemical doping in various acid solutions
Fig. S2. Relationship between maximum power density and slopes of linear regression for $I_p$ and $v^{1/2}$. Maximum power density of PANI can be calculated by equations (S1) and (S2).

Fig. S3 Cycling performance of PANI(H$_2$SO$_4$)-ES films with different dopant anions in the corresponding acids after 1000 cycles at 100 mV s$^{-1}$. 