SUPPORTING INFORMATION

High-performance symmetric supercapacitor device based on carbonized iron-polyaniline/nickel graphene foam

M. N. Rantho, M. J. Madito and N. Manyala*

Department of Physics, Institute of Applied Materials, SARChI Chair in Carbon Technology and Materials, University of Pretoria 0028, South Africa.

*Corresponding author's email: ncholu.manyala@up.ac.za, Tel.: + (27)12 420 3549; Fax: + (27)12 420 2516

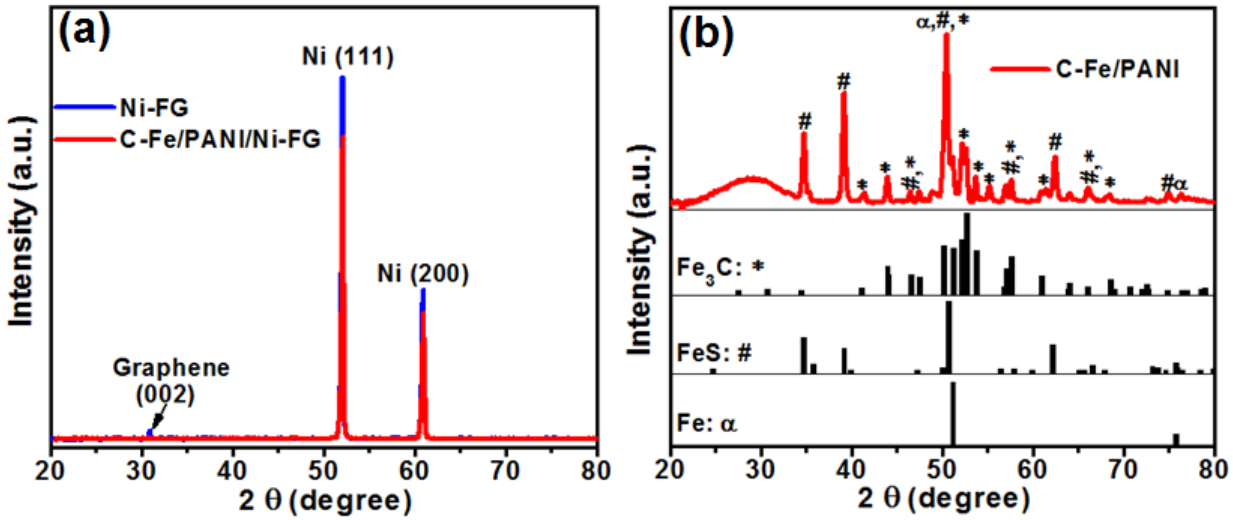

Figure S1. (a) The XRD pattern of the as-synthesized Ni-GF and C-Fe/PANI/Ni-GF. (b) The XRD pattern of the as-synthesized C-Fe/PANI without Ni-GF, and the matching ICSD cards for Fe_3C, FeS and Fe.

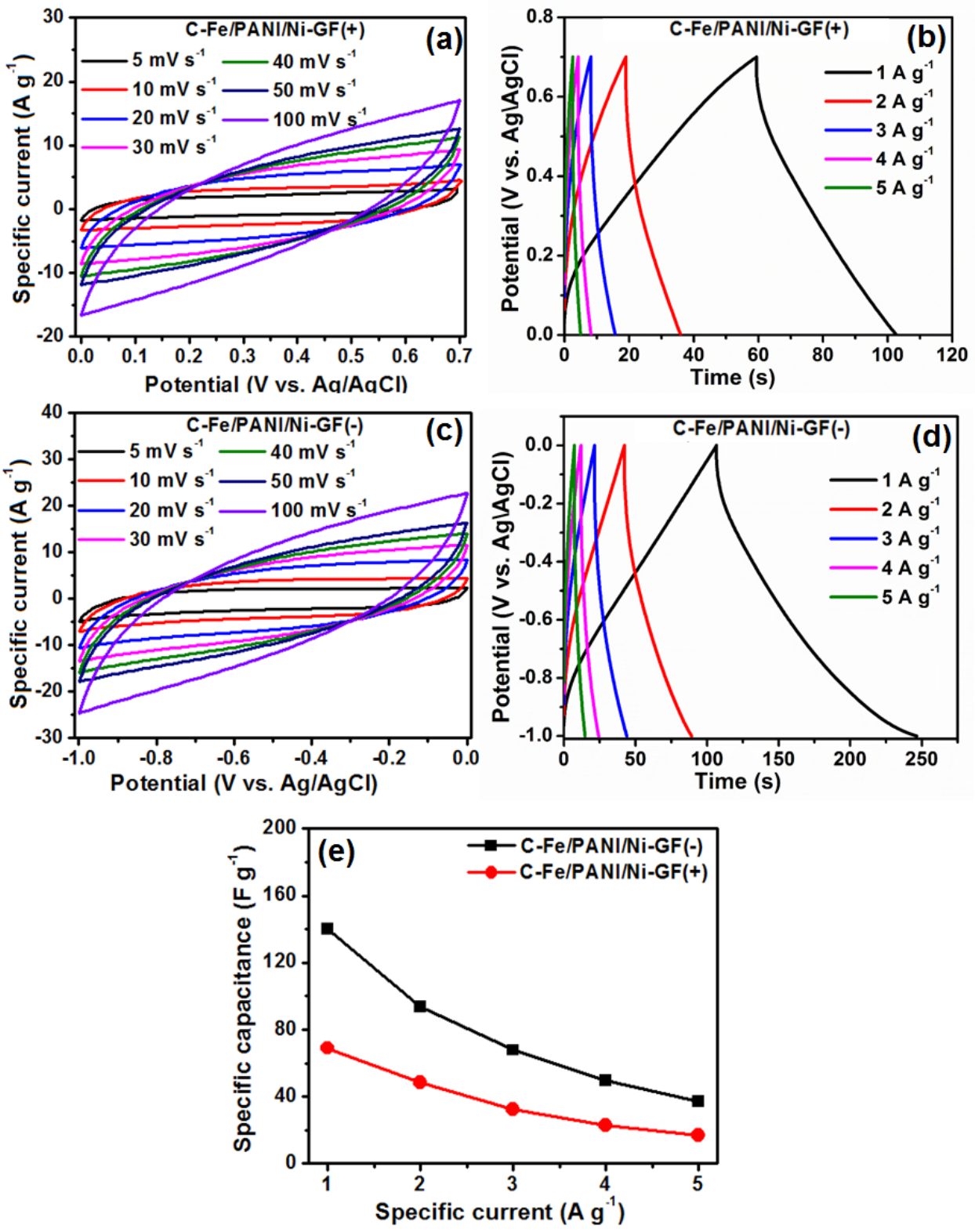

Figure S2. (a) CV curves of C-Fe/PANI/Ni-GF positive electrode at different scan rates in a potential window range of 0.0 to 0.7 V. (b) GCD curves of the C-Fe/PANI/Ni-GF positive

electrode at different specific currents. (c) CV curves of C-Fe/PANI/Ni-GF negative electrode at different scan rates in a potential window range of -1.0 to 0.0 V. (d) GCD curves of the C-Fe/PANI/Ni-GF negative electrode at different specific currents. (e) Specific capacitance as a function of specific current for C-Fe/PANI/Ni-GF positive and negative electrode.

For better performance of the device, the charge balance, $Q_+ = Q_-$ was done, where Q_+ and Q_- are charge stored in the electrode in both positive and negative potential window respectively. Based on the charge definition, $Q = C_S m \Delta V$, the mass balance between the electrode in positive and negative potential window was achieved ($m_+/m_- \approx 1$) using the following expression [40]:

$$\frac{m_+}{m_-} = \frac{C_{S(-)} \times V_-}{C_{S(+)} \times V_+} \quad \text{(S1)}$$

where $C_{S(+)}$ and $C_{S(-)}$ are the specific capacitance of the active material of the electrodes in the positive and negative potential window respectively, m_+ and m_- are the masses of the active material of the electrodes in positive and negative potential window, and V_+ and V_- are the positive and negative potential windows of the working electrodes respectively.

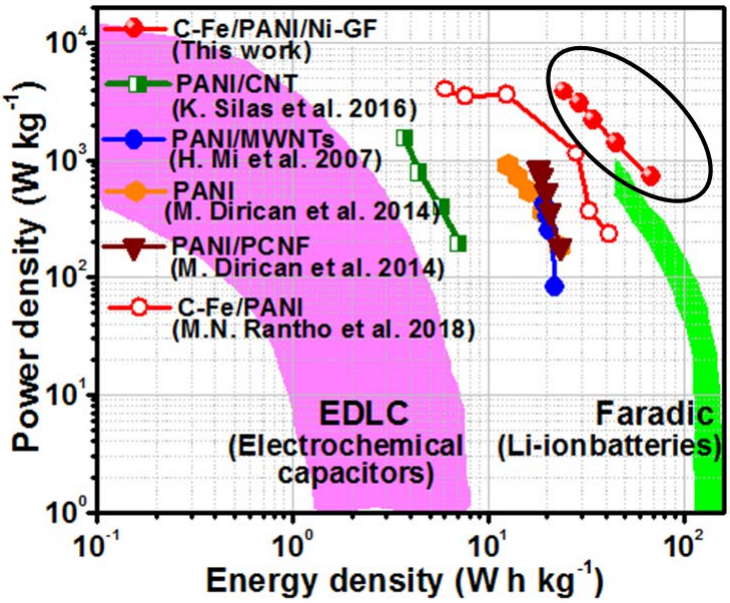

Figure S3. Ragone plot of the C-Fe/PANI/Ni-GF symmetric device and PANI based symmetric devices, including the energy and power density regions for lithium-ion batteries (Faradic behavior) and electrochemical capacitors (EDLC behavior).