Electronic supplementary information

Polymer matrix-assisted commercial-level mass loading of porous cobalt manganese nitride towards high-performance binder-free electrodes for hybrid supercapacitors

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S1. Characterizations

Field-emission scanning electron microscope (FE-SEM, Carl Zesis) equipped with energy-dispersive X-ray (EDX) spectroscopy analysis was employed to study the surface morphologies and elements of the prepared samples. Intrinsic morphology was investigated using transmission electron microscope (TEM). Based on the isotherms, the Brunauer−Emmett−Teller (BET) method and Barrett, Joyner and Halenda (BJH) method were used to calculate the specific surface area and pore size distribution, respectively. The crystal structure of the prepared samples was investigated by X-ray diffraction (XRD, Mac Science M18XHF-SRA, Cu Kα radiation; λ = 1.5406 Å). The existing oxidation states of elements in the optimized sample were investigated by X-ray photoelectron spectroscopy (XPS, K-alpha (Thermo Electron)) analysis.

S2. Calculations

The well-known formulae for specific capacitance (*Cs*), mass ratio, energy density (*E*), aerial capacitance (*A*), and power density (*P*) are shown below:

$$Cs = \frac{I \times dt}{m \times dV} \tag{S1}$$

$$E = \frac{1}{2}\left(Cs \times (dV)^2\right) \tag{S2}$$

$$P = \frac{E}{dt} \tag{S3}$$

$$\frac{m_+}{m_-} = \frac{Cs_- \times dV}{Cs_+ \times dV} \quad \text{(S4)}$$

$$A = \frac{I \times dt}{a \times dV} \quad \text{(S5)}$$

where Cs (F g^{-1}) is the specific capacitance, E (Wh kg^{-1}) is the energy density, P (W kg^{-1}) is the power density, dt (s) is the discharge time, m_+ and m_- are the masses of positive and negative electrodes, respectively, Cs_- and Cs_+ are the specific capacitances of negative and positive electrodes, respectively, I (A) is the applied current, m (g) is the mass of active material, and dV (V) is the potential window, A (F cm^{-2}) is the areal capacitance, and a (cm^2) is the electrode material grown area.

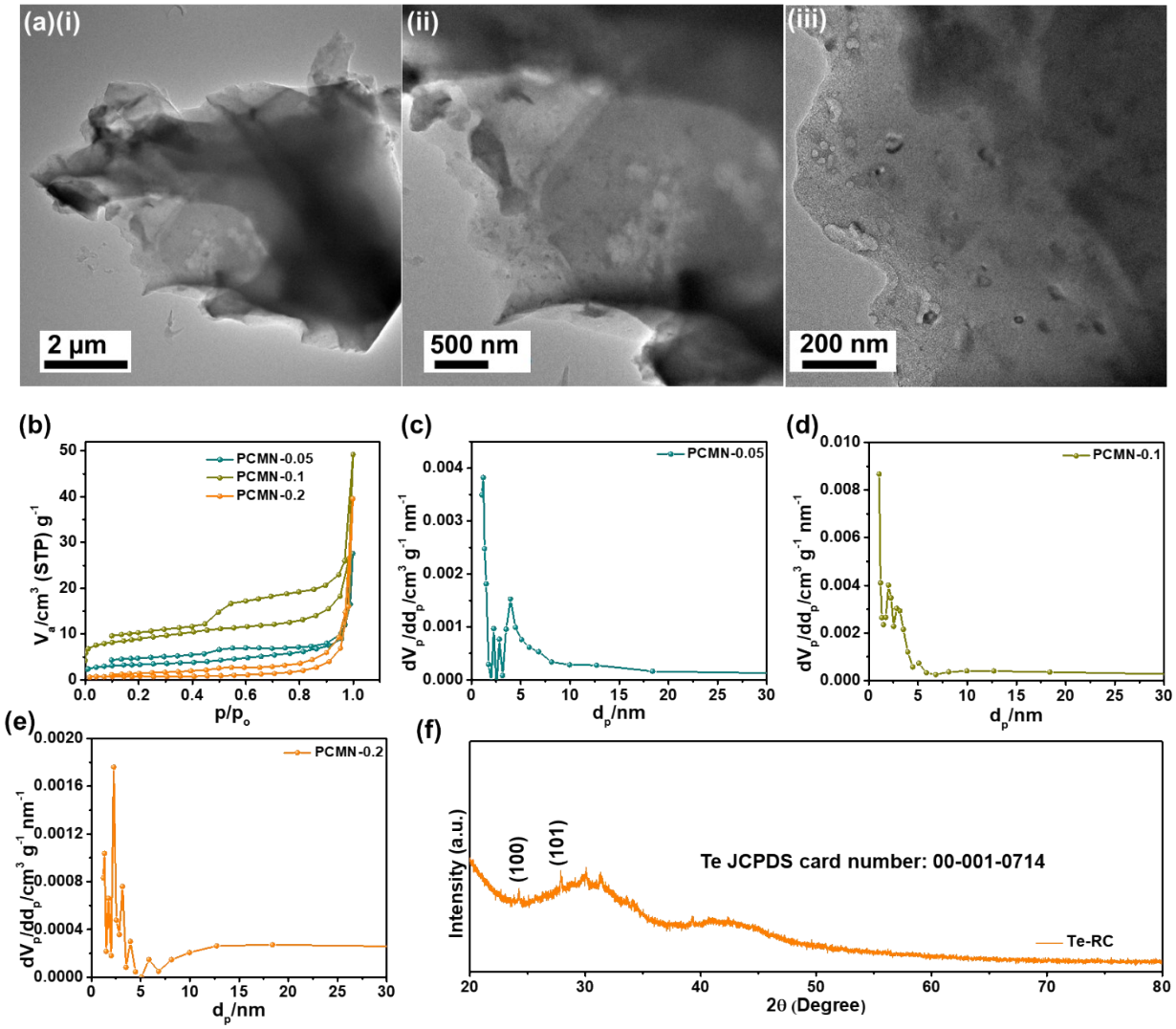

Fig. S1. (a)(i-iii) TEM images of the Te-RC material. (b) N_2 adsorption–desorption isotherms and (c-e) pore size distribution curves of all the PCMN samples. (f) XRD pattern of the Te-RC material.

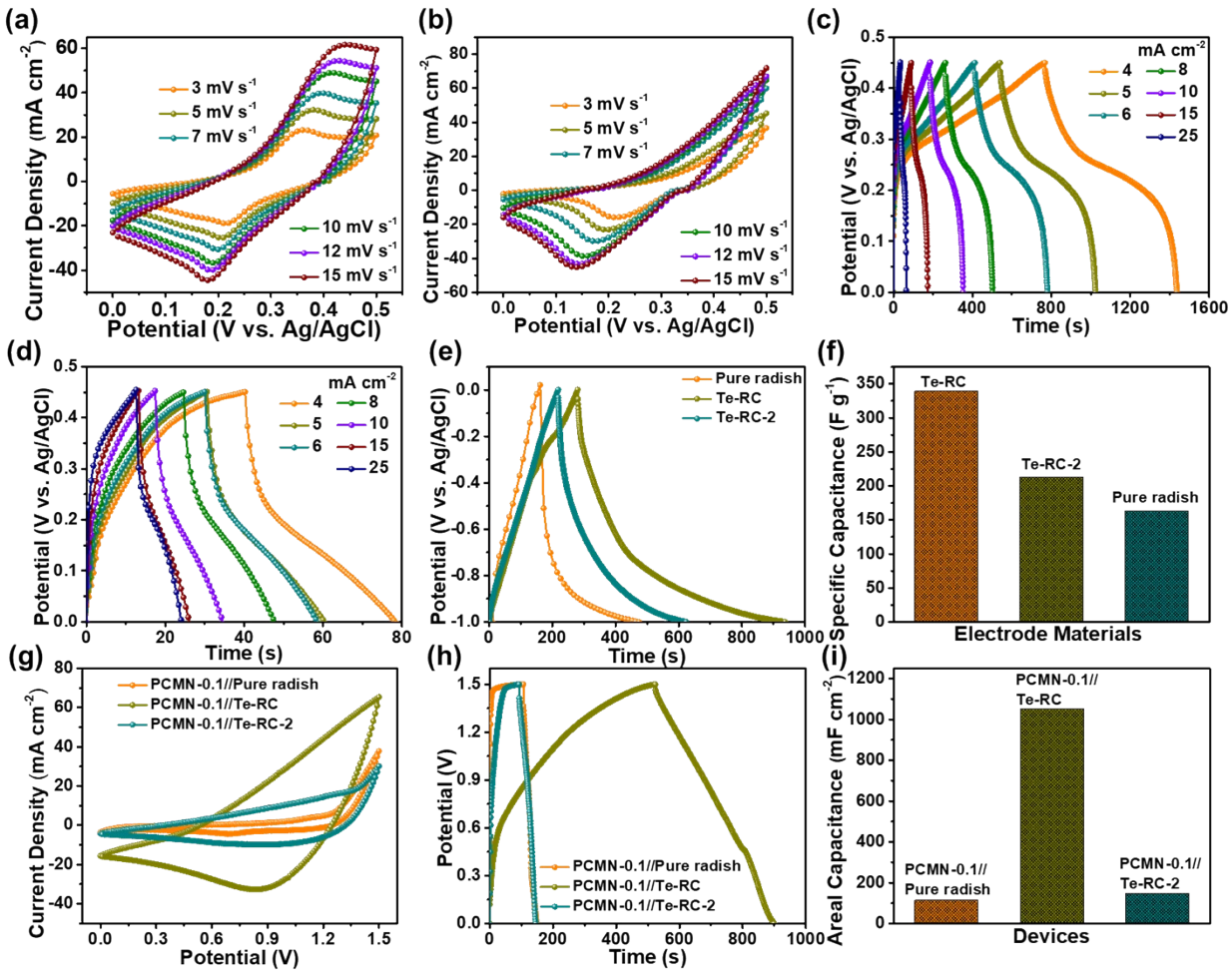

Fig. S2. CV curves of the (a) PCMN-0.05 and (b) PCMN-2 electrodes. GCD curves of the (c) PCMN-0.05 and (d) PCMN-2 electrodes. Comparative (e) GCD curves and (f) specific capacitance values of the prepared negative electrodes at 0.5 A g^{-1}. Comparative (g) CV curves, (h) GCD curves, and areal capacitance values of the prepared QHSC devices.