

Controlled Electrochemical Surface Exfoliation of Graphite Pencil Electrodes for High-Performance Supercapacitors

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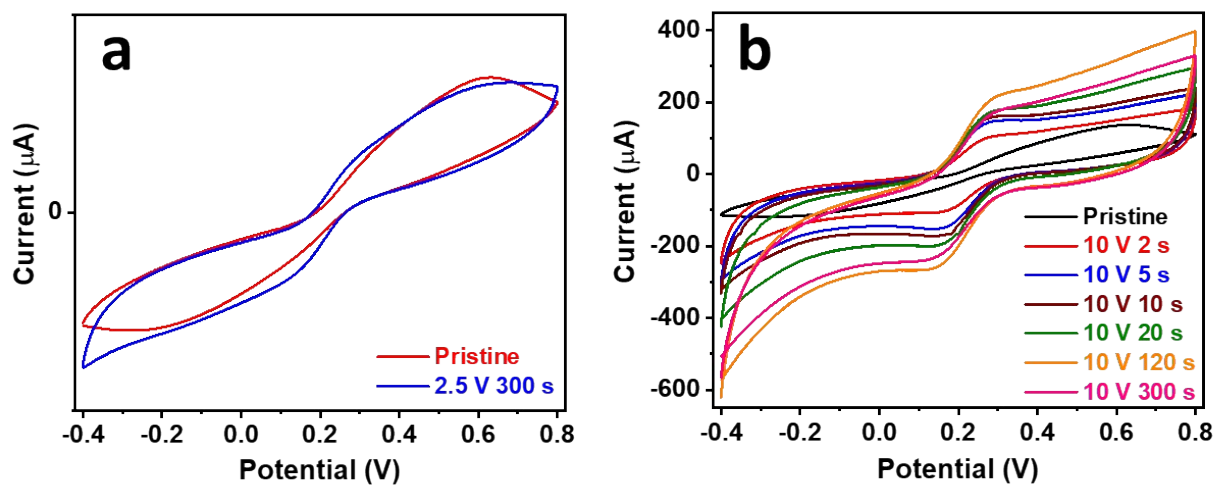


Fig. S1. CV profiles of pristine GPE and SEGPEs exfoliated at (a) 2.5 V for 300 s and (b) 10 V for different durations, at a scan rate of 100 mV/s in 5 mM $\text{Fe}(\text{CN})_6^{3-/4-}/0.1$ M KCl.

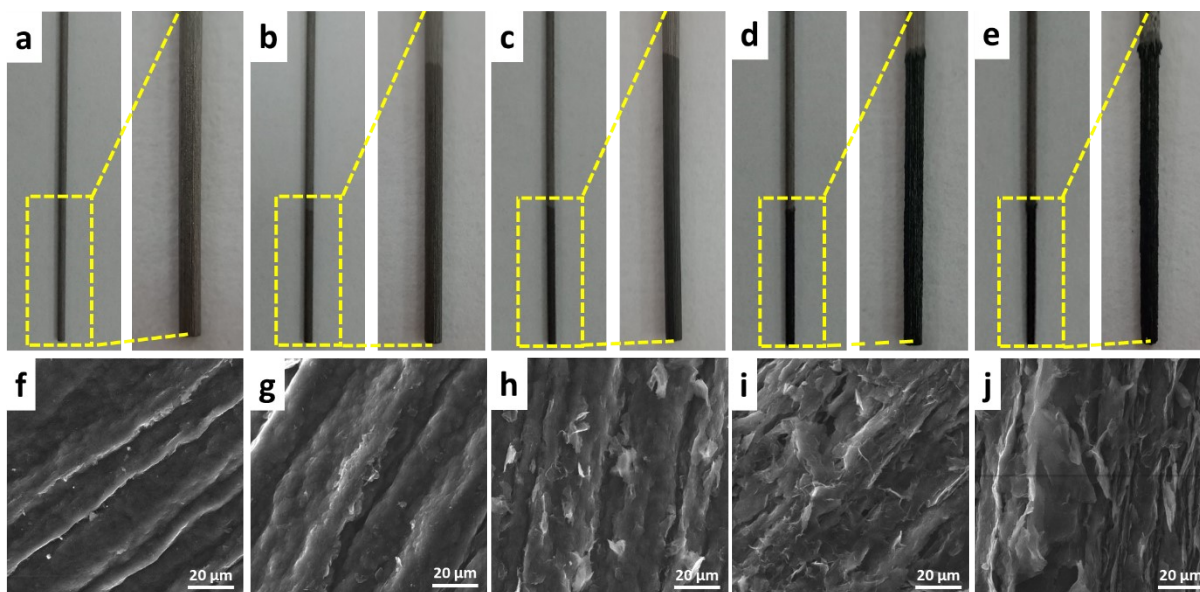


Fig. S2. (a–e) Digital photographs of the whole (left) and active area (right), and (f–j) SEM images of (a, f) pristine GPE, and (b–e; g–j) SEGPEs exfoliated at (b, g) 5 V 1 s, (c, h) 5 V 10 s, (d, i) 5 V 300 s, and (e, j) 5 V 600 s.

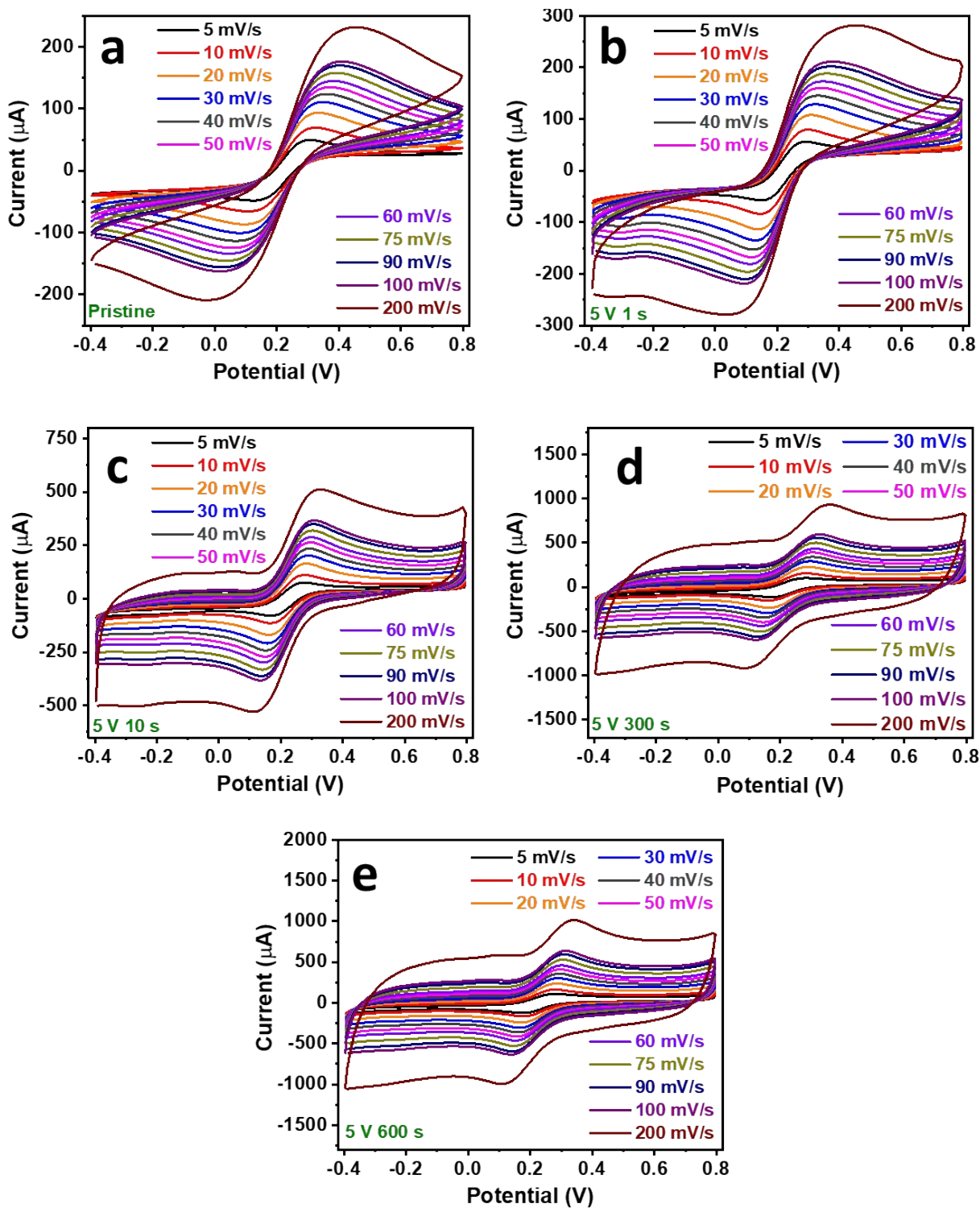


Fig. S3. CV profiles of (a) pristine GPE and (b–e) SEGPEs exfoliated at 5 V for (b) 1 s, (c) 10 s, (d) 300 s, and (e) 600 s in 5 mM $\text{Fe}(\text{CN})_6^{3-/4-}/0.1 \text{ M KCl}$ at different scan rates.

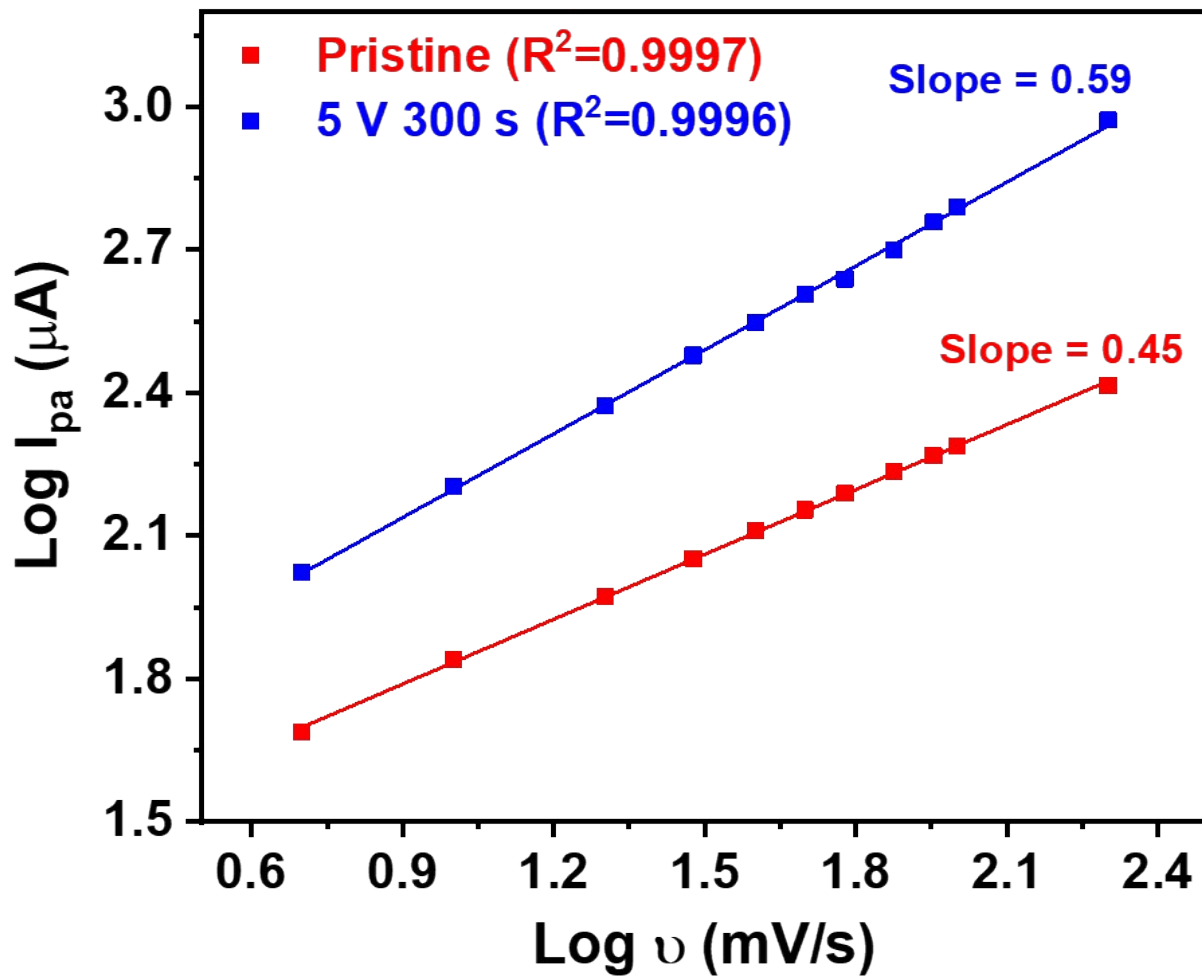


Fig. S4. Log anodic peak current (I_{pa}) vs. $\log v$ plot of pristine GPE and SEGPE (5 V, 300 s) in 5 mM $\text{Fe}(\text{CN})_6^{3-/4-}/0.1 \text{ M KCl}$.

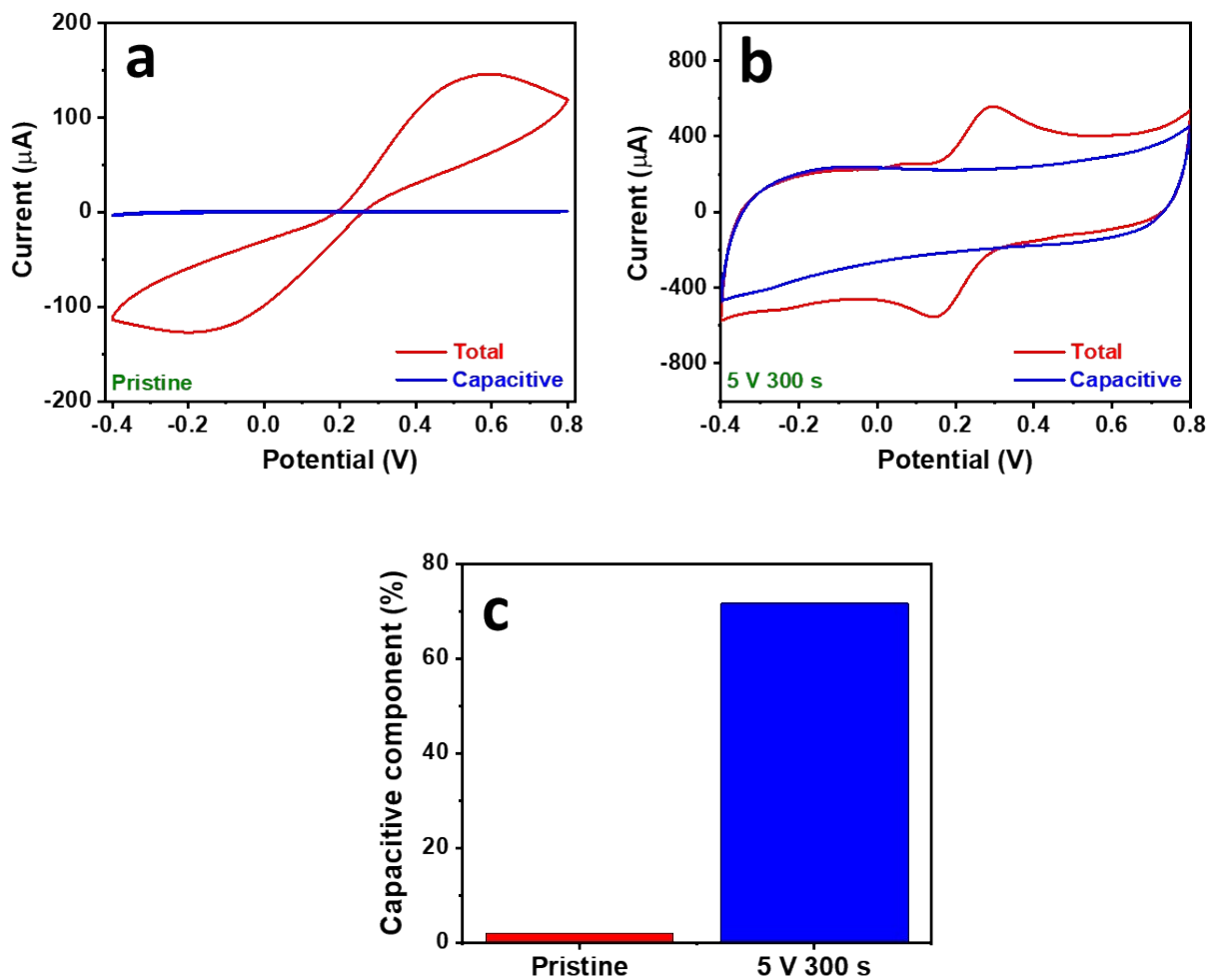


Fig. S5. CV profiles of (a) pristine and (b) SEGPE (5 V 300 s) in 5 mM $\text{Fe}(\text{CN})_6^{3-/4-}/0.1$ M KCl (total current) and 0.1 M KCl only (capacitive current) at a scan rate of 100 mV/S. (c) Comparison between the CV capacitive component of the pristine GPE and SEGPE (5 V, 300 s).

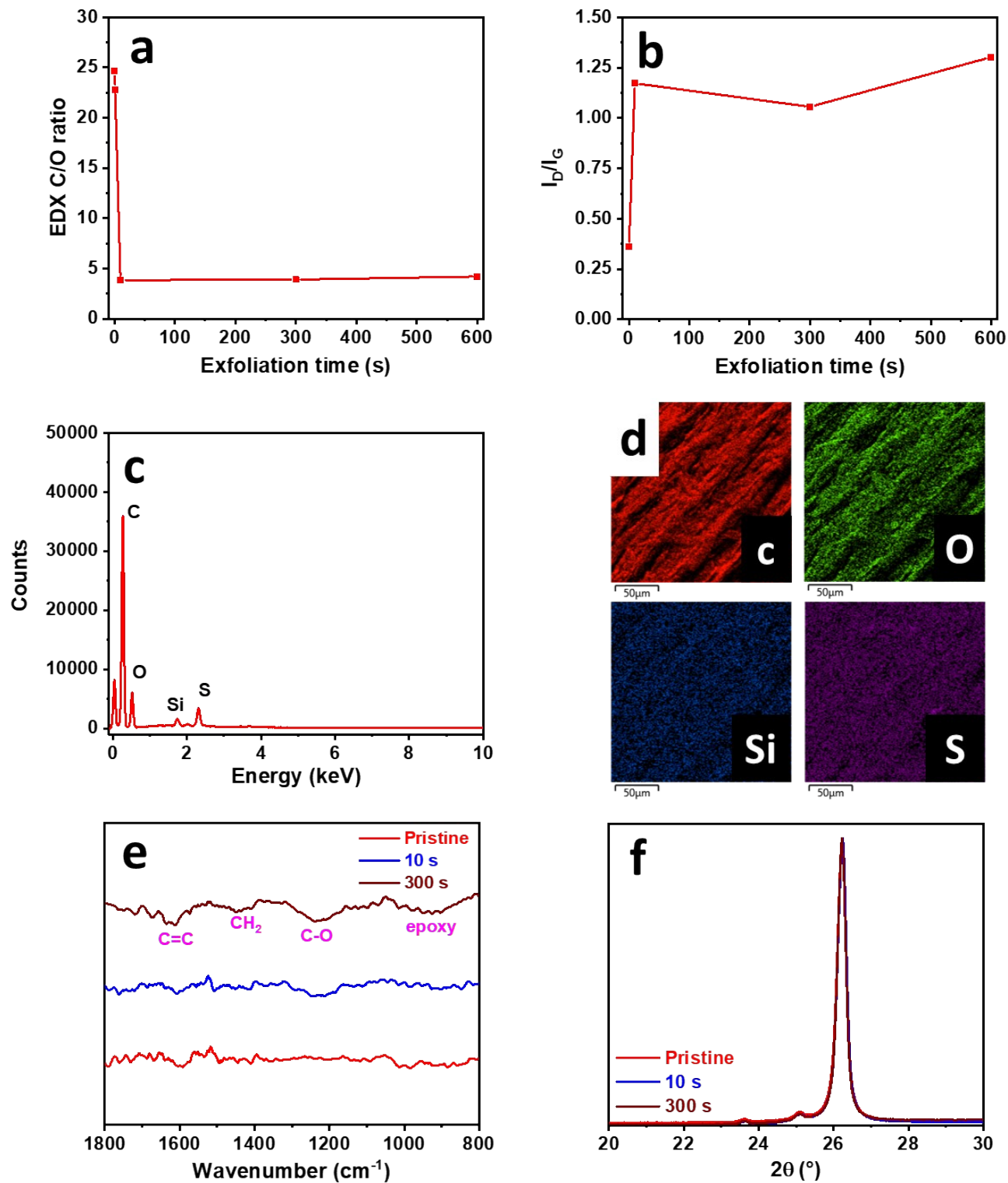


Fig. S6. (a) EDX C/O and (b) Raman I_D/I_G ratio analysis of SEGPEs exfoliated at 5 V for different durations. (c–d) EDX (c) spectrum and (d) mapping images of SEGPE exfoliated at 5 V for 300 s. (e) FTIR spectra and (f) XRD patterns of pristine GPE and SEGPEs exfoliated at 5 V for different durations.

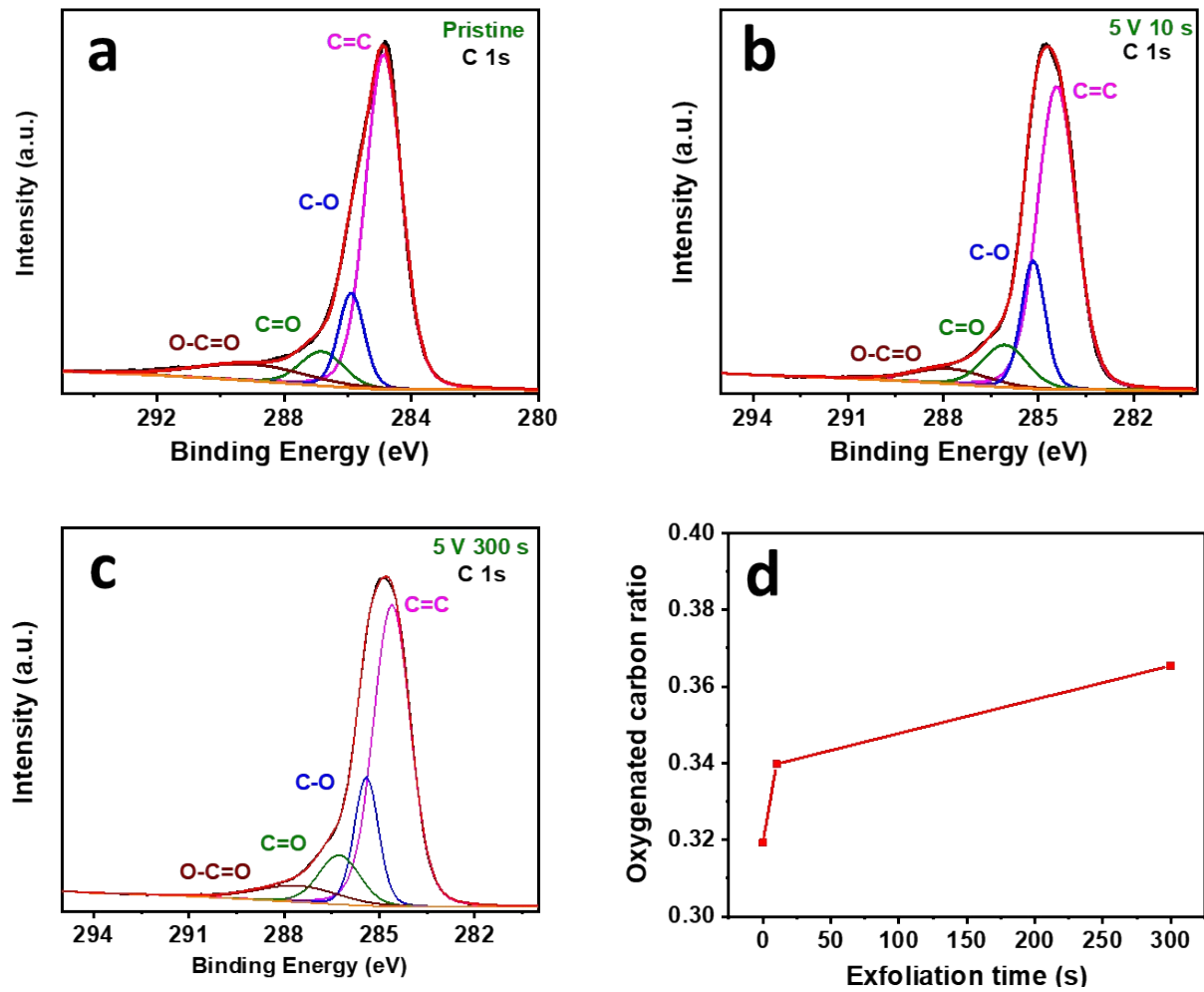


Fig. S7. XPS C 1s core level spectra of (a) pristine GPE and (b–c) SEGPEs exfoliated at 5 V for (b) 10 s and (c) 300 s. (d) oxygenated carbon ratio vs. exfoliation time plot.

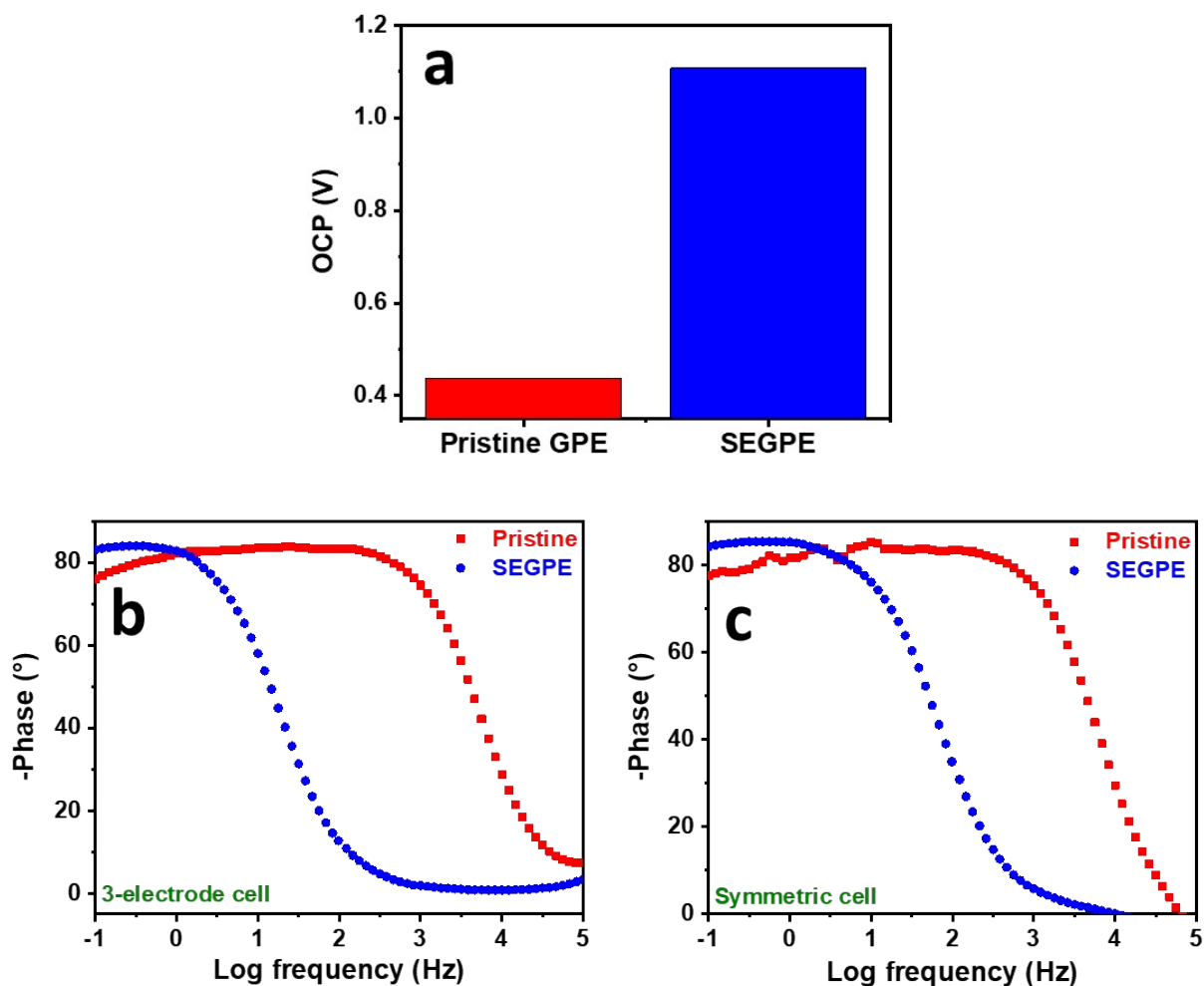


Fig. S8. Comparison between OCP of pristine GPE and SEGPE (5 V, 300) in a 3-electrode setup. (b–c) Bode plots of pristine GPE and SEGPE (5 V, 300 s) in (b) 3-electrode and (c) symmetric setups.

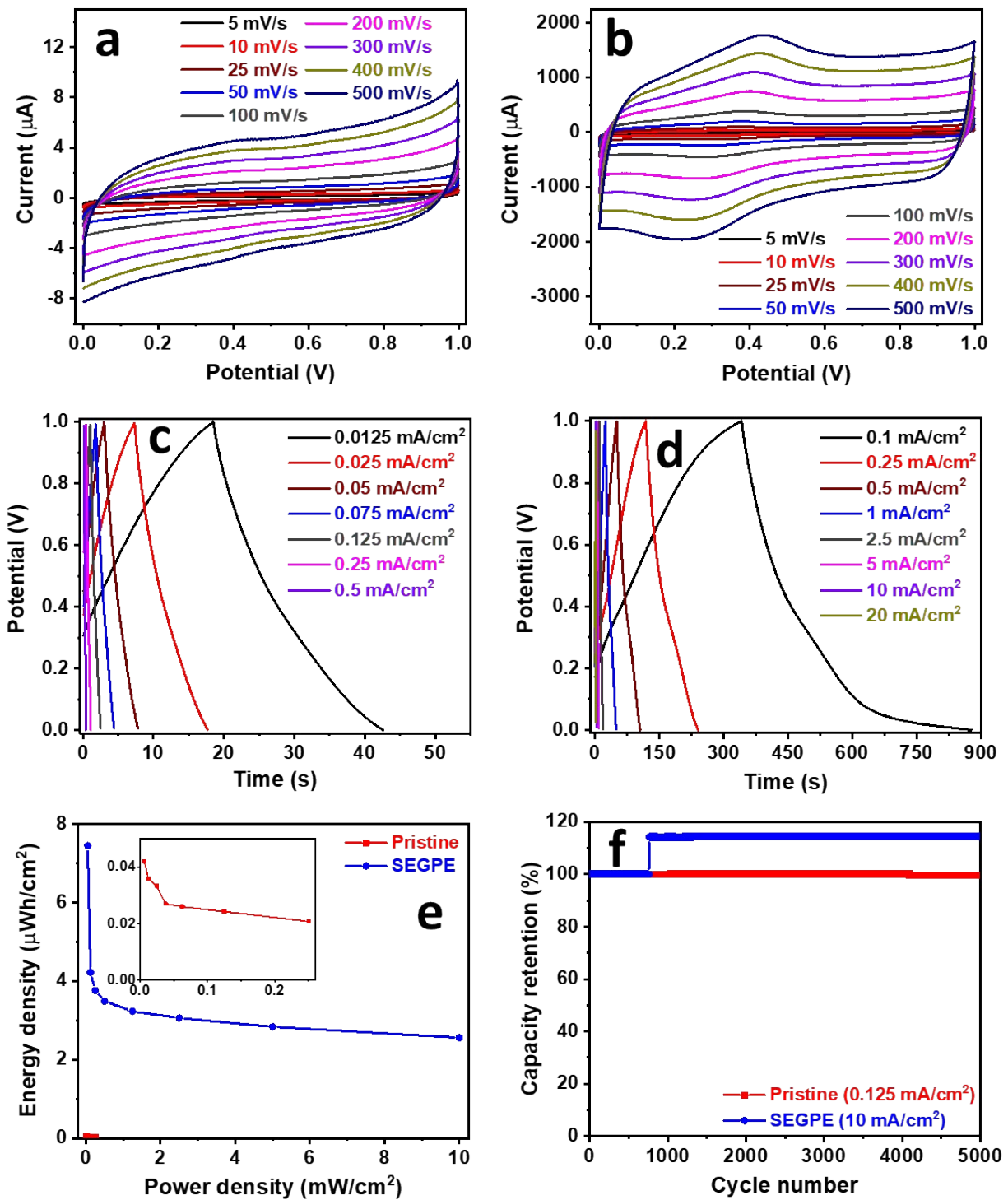


Fig. S9. (a–b) CV profiles at different scan rates, (c–d) GCD curves at different current densities, (e) areal Ragone plots, and (f) stability profiles of (a, c, e–f) pristine GPE and (b, d, e–f) SEGPE (5 V, 300 s) in a 3-electrode setup. Inset in (e): Magnified plot of pristine GPE.

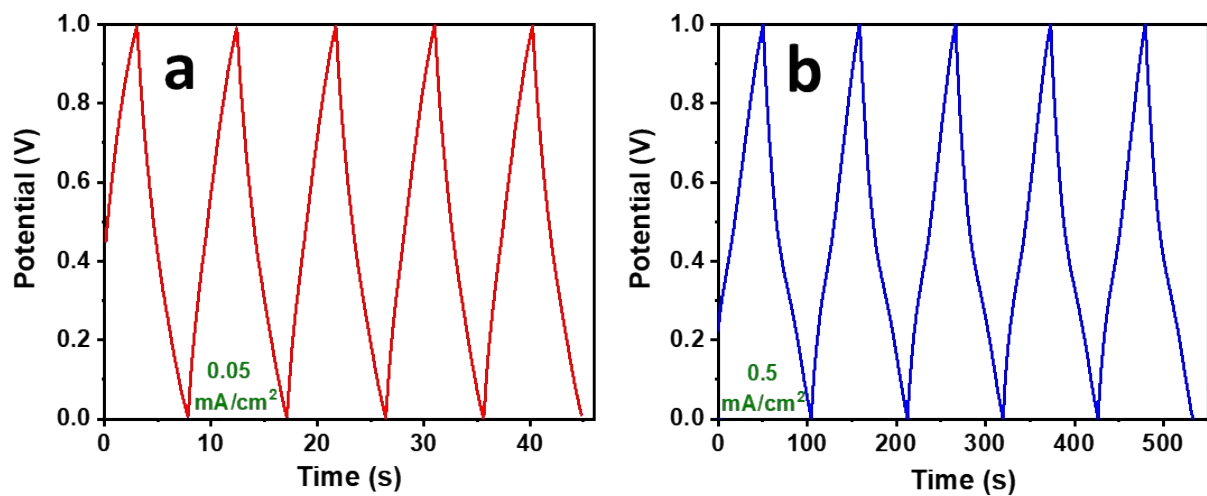


Fig. S10. GCD Profiles of (a) Pristine GPE and (b) SEGPE (5 V, 300 s) in a 3-electrode setup.

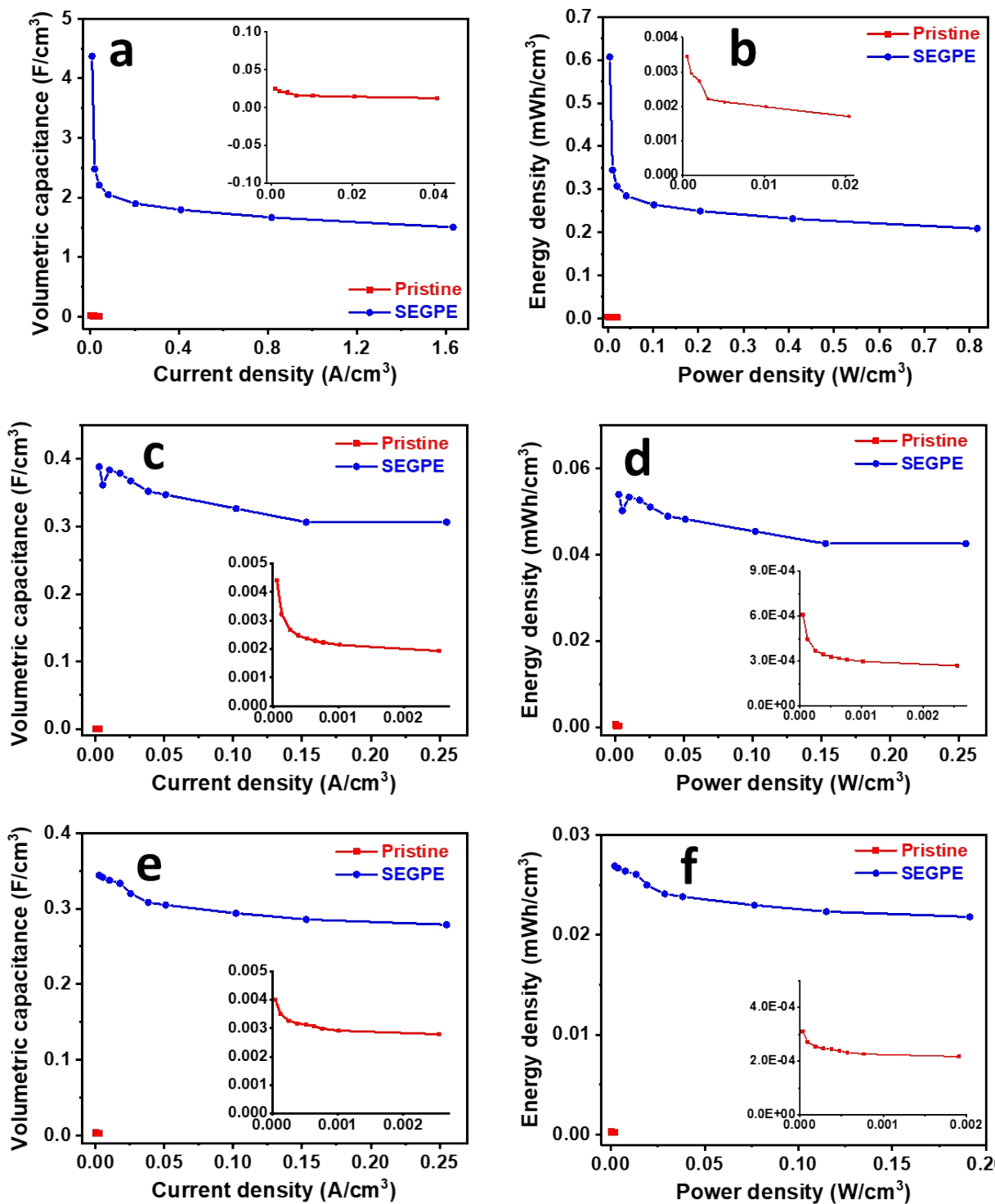


Fig. S11. Volumetric (a, c, e) capacitance vs. current density and (b, d, f) Ragone plots of pristine GPE and SEGPE (5 V, 300 s) in (a–b) 3-electrode, (c–d) 1 V symmetric, and (e–f) 0.75 V symmetric cell setups.

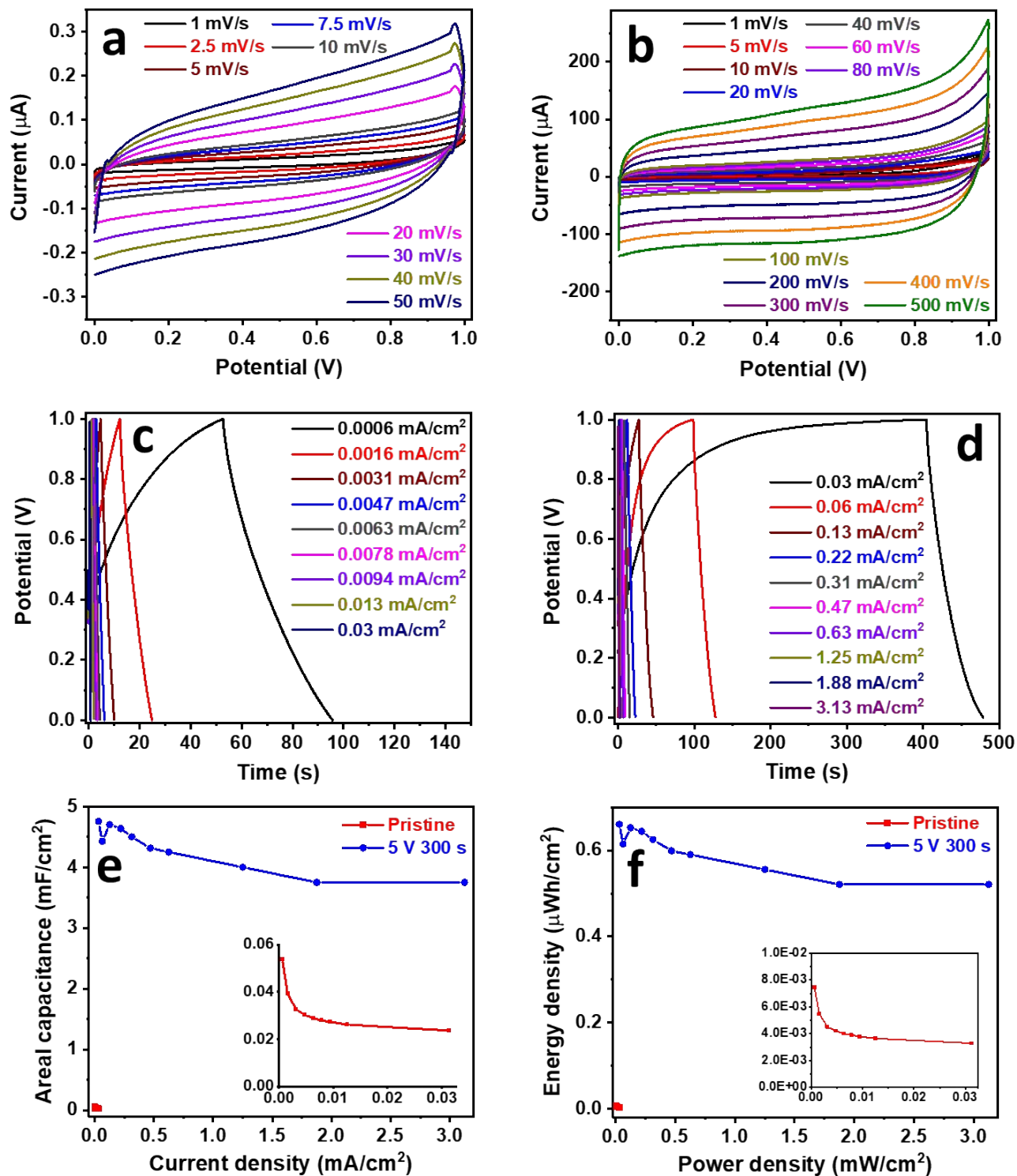


Fig. S12. (a–b) CV profiles at different scan rates, (c–d) GCD curves at different current densities, (e) areal capacitance vs. current density profiles, and (f) areal Ragone plots of (a, c, e, f) pristine GPE and (b, d, e, f) SEGPE (5 V, 300 s) in a 1 V symmetric cell setup.

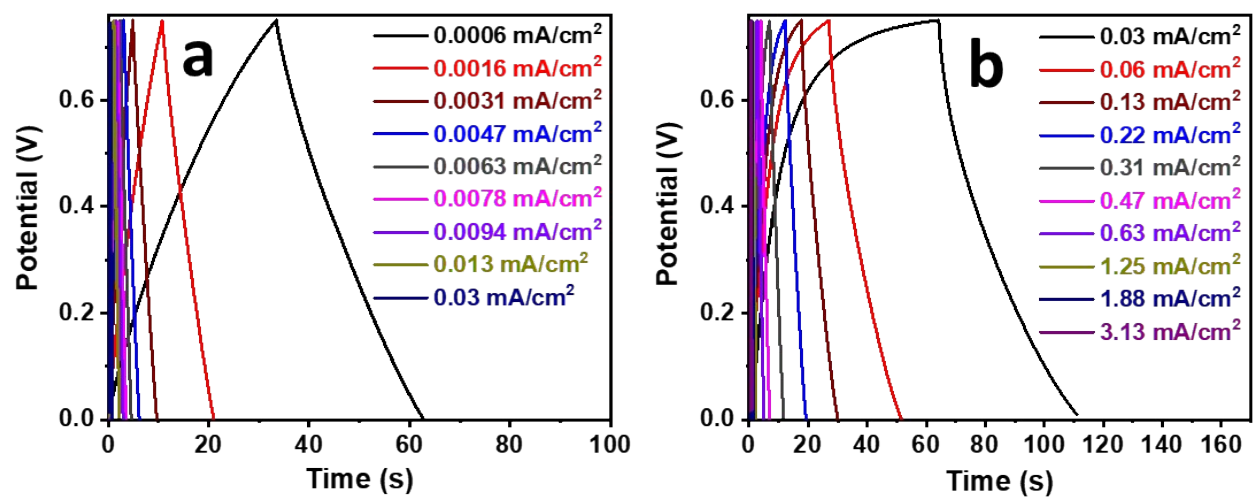


Fig. S13. CV profiles at different scan rates of (a) pristine and (b) SEGPE (5 V, 300 s) in a 0.75 V symmetric cell setup.