Electronic Supplementary Material (ESI) for Nanoscale.
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Supplementary Material:

Extending the Lifetime of Vanadium Redox Flow Batteries by Reactivation of Carbon Electrode Materials

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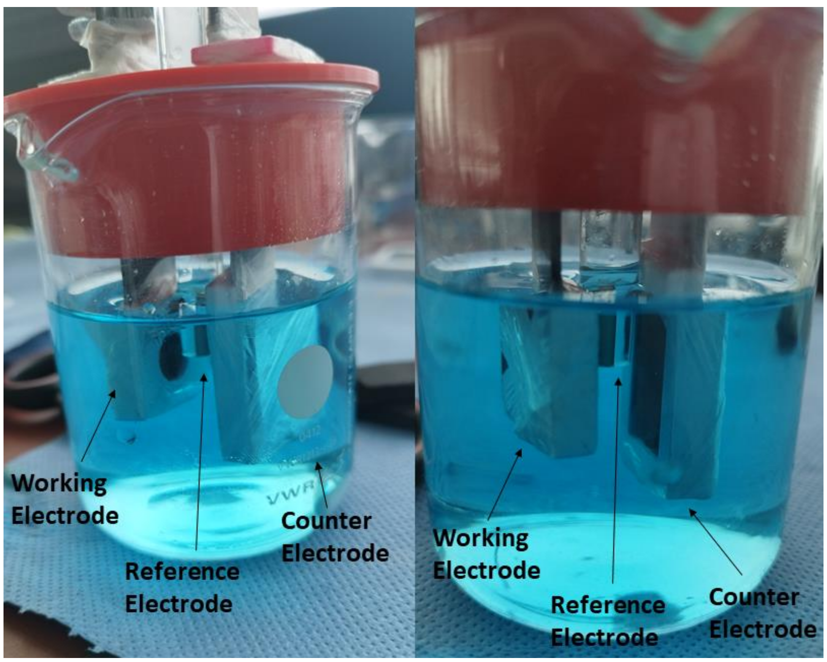


Figure S1: Half-cell cycling with the similar exposed area and defined distances between working, counter, and reference electrodes.

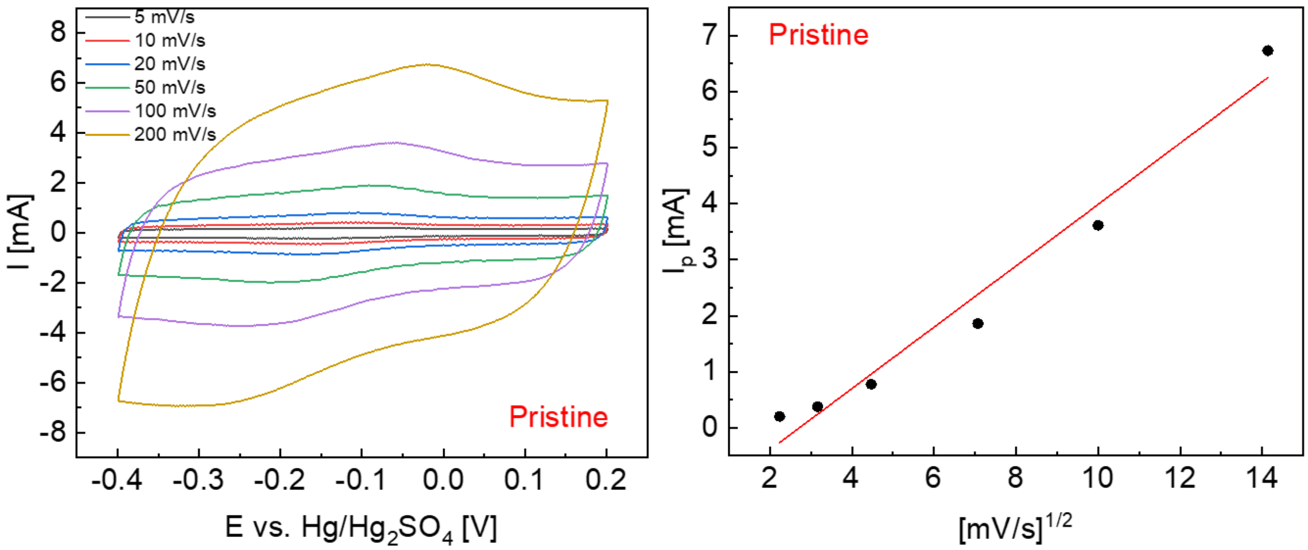


Figure S2. ECSA of pristine thermally activated felt.

C_{dl} = 0.5475 mF, C_{sp} = 0.02 mF/cm^2

ECSA = C_{dl}/C_{sp} = 0.5475/0.02 = 27.4 cm^2

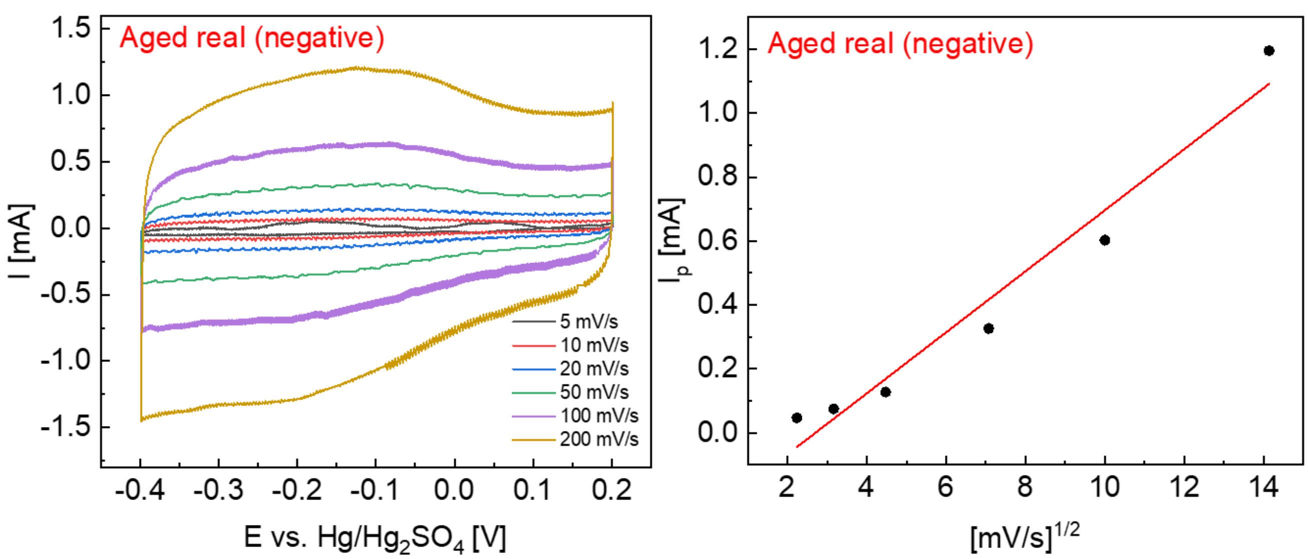


Figure S3: ECSA of the aged real felt (negative).

C_{dl} = 0.0954 mF, C_{sp} = 0.02 mF/cm^2

ECSA = C_{dl}/C_{sp} = 0.0954/0.02 = 4.8 cm^2

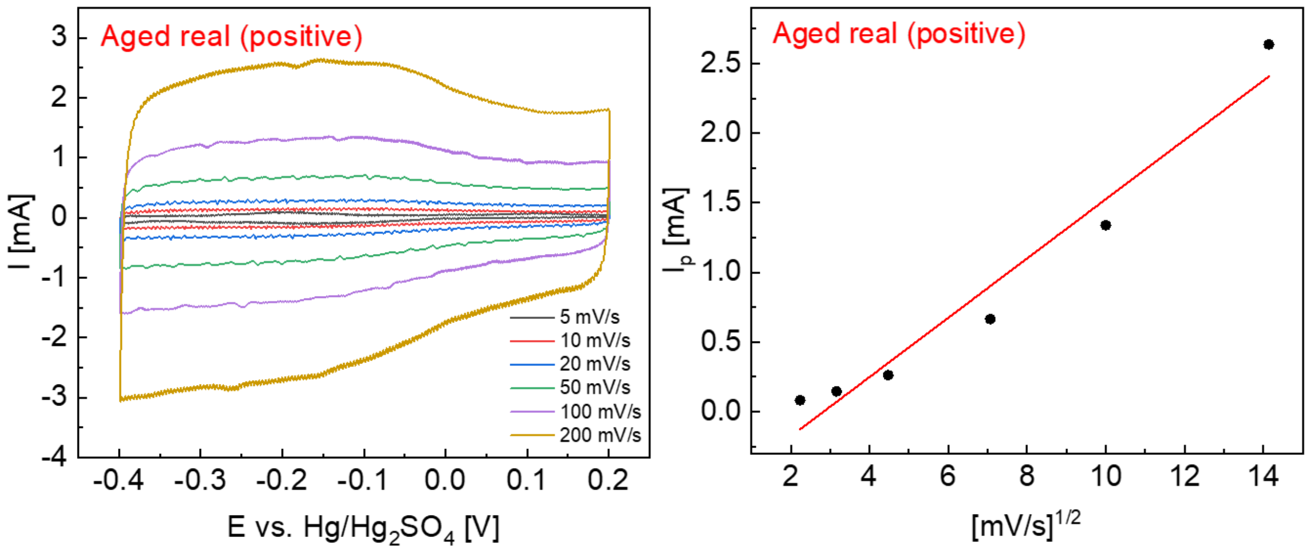


Figure S4: ECSA of the aged real felt (positive).

C_{dl} = 0.2129 mF, C_{sp} = 0.02 mF/cm^2

ECSA = C_{dl}/C_{sp} = 0.2129/0.02 = 10.6 cm^2

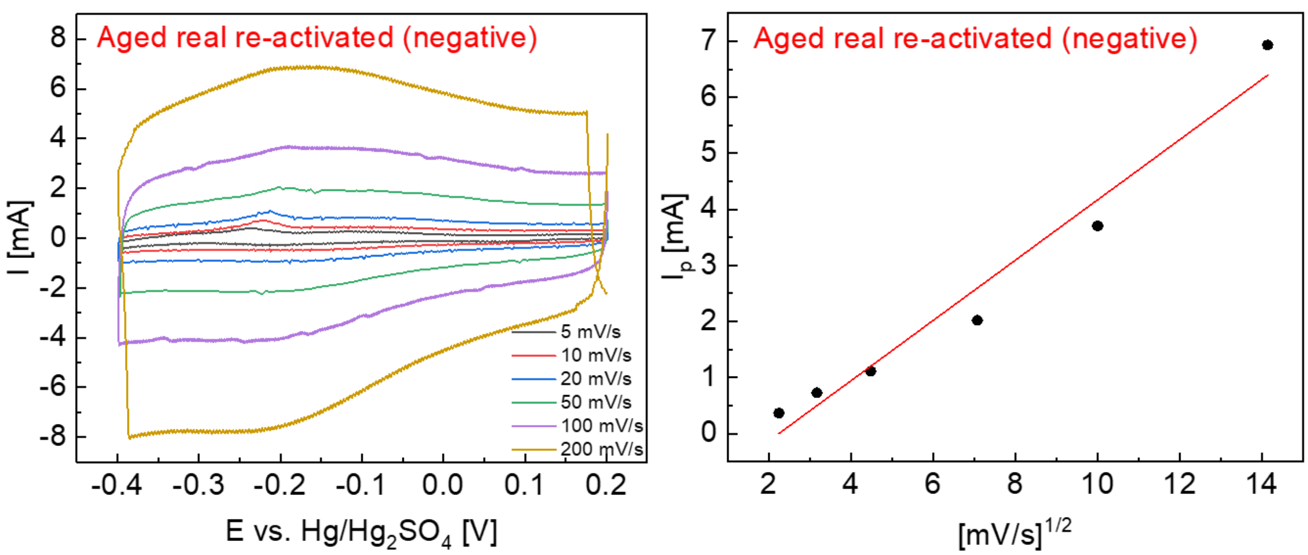


Figure S5: ECSA of the aged real re-activated felt (negative).

C_{dl} = 0.5372 mF, C_{sp} = 0.02 mF/cm^2

ECSA = C_{dl}/C_{sp} = 0.5372/0.02 = 26.86 cm^2

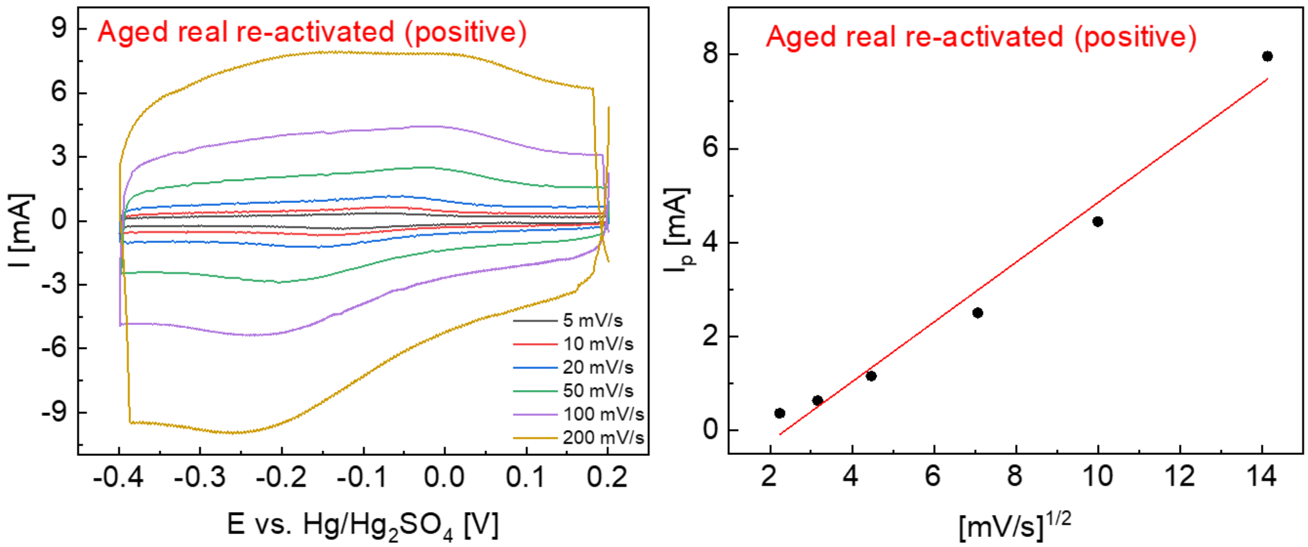


Figure S6: ECSA of the aged real re-activated felt (positive).

C_{dl} = 0.6354 mF, C_{sp} = 0.02 mF/cm^2

ECSA = C_{dl}/C_{sp} = 0.6354/0.02 = 31.77 cm^2

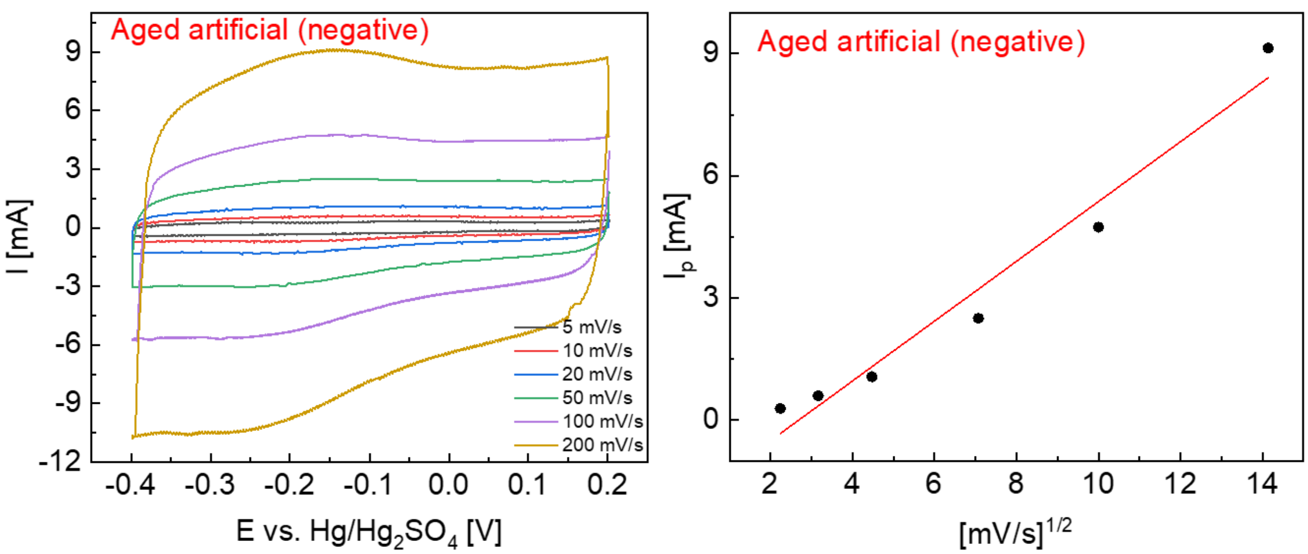


Figure S7: ECSA of the aged artificial felt (negative).

C_{dl} = 0.7341 mF, C_{sp} = 0.02 mF/cm^2

ECSA = C_{dl}/C_{sp} = 0.7341/0.02 = 36.7 cm^2

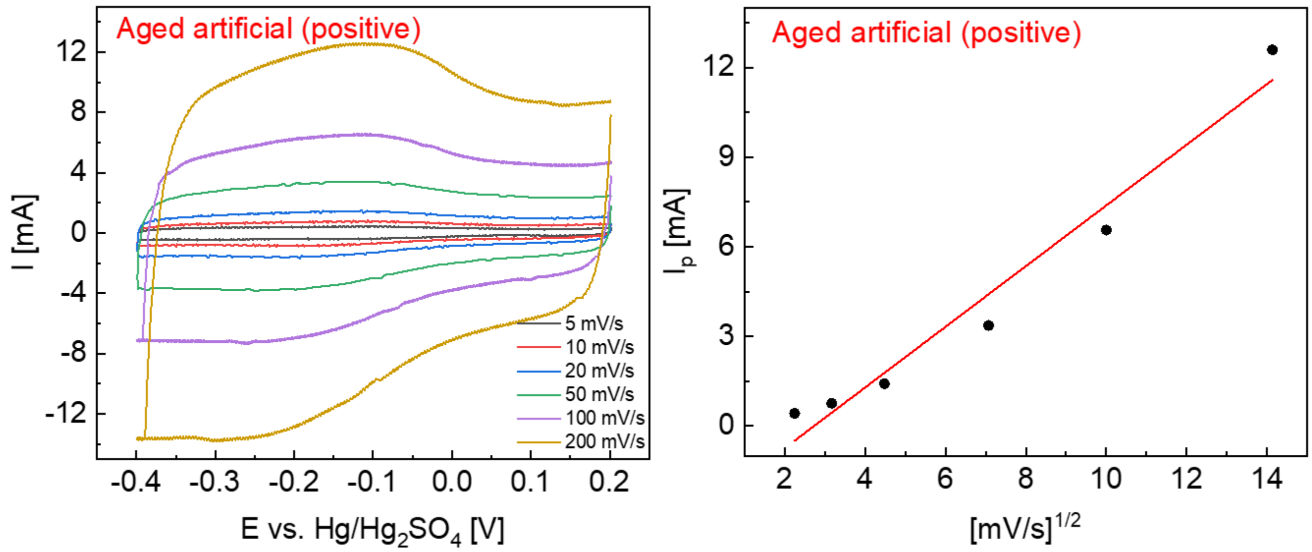


Figure S8: ECSA of the aged artificial felt (positive).

C_{dl} = 1.0148 mF, C_{sp} = 0.02 mF/cm^2

ECSA = C_{dl}/C_{sp} = 1.0148/0.02 = 50.74 cm^2

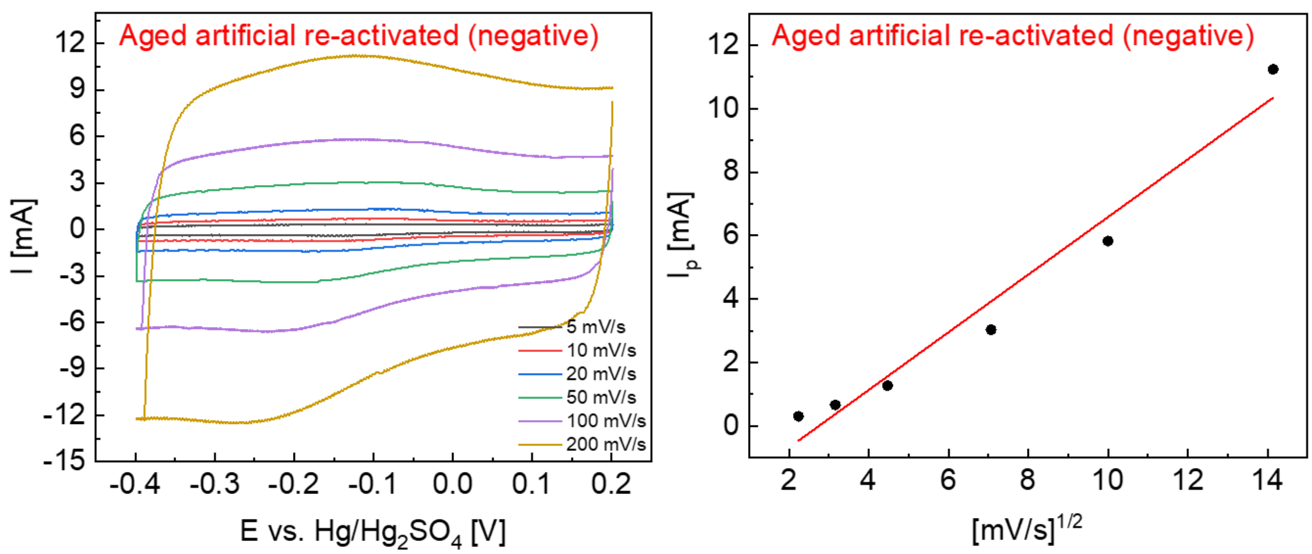


Figure S9: ECSA of the aged artificial re-activated felt (negative).

C_{dl} = 0.9083 mF, C_{sp} = 0.02 mF/cm^2

ECSA = C_{dl}/C_{sp} = 0.9083/0.02 = 45.42 cm^2

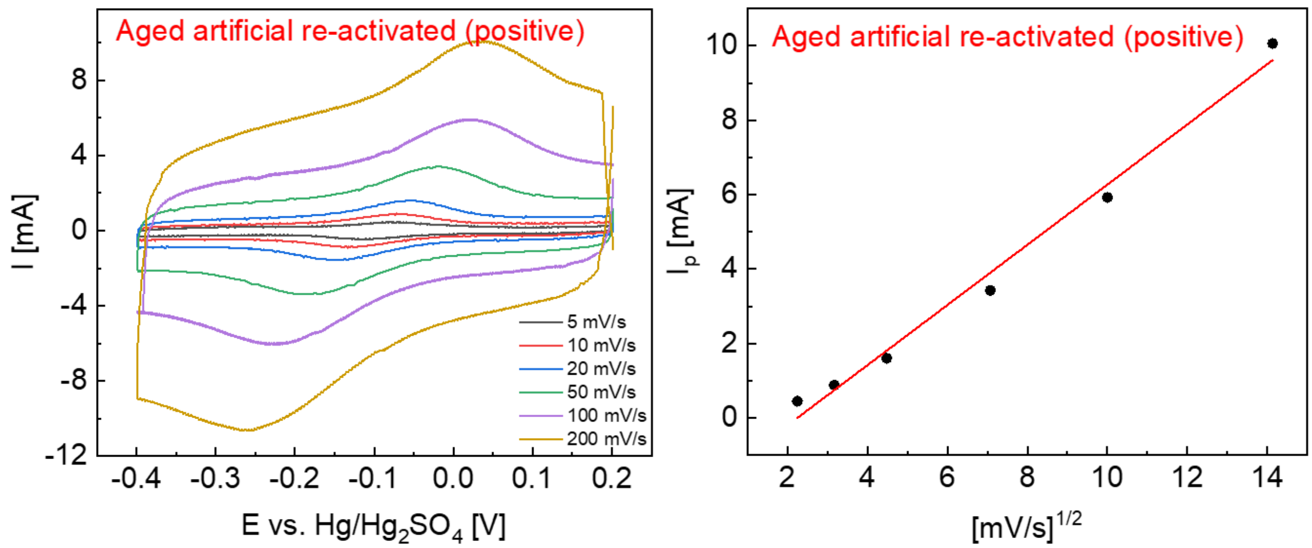


Figure S10: ECSA of the aged artificial re-activated felt (positive).

C_{dl} = 0.8079 mF, C_{sp} = 0.02 mF/cm^2

ECSA = C_{dl}/C_{sp} = 0.8079/0.02 = 40.39 cm^2

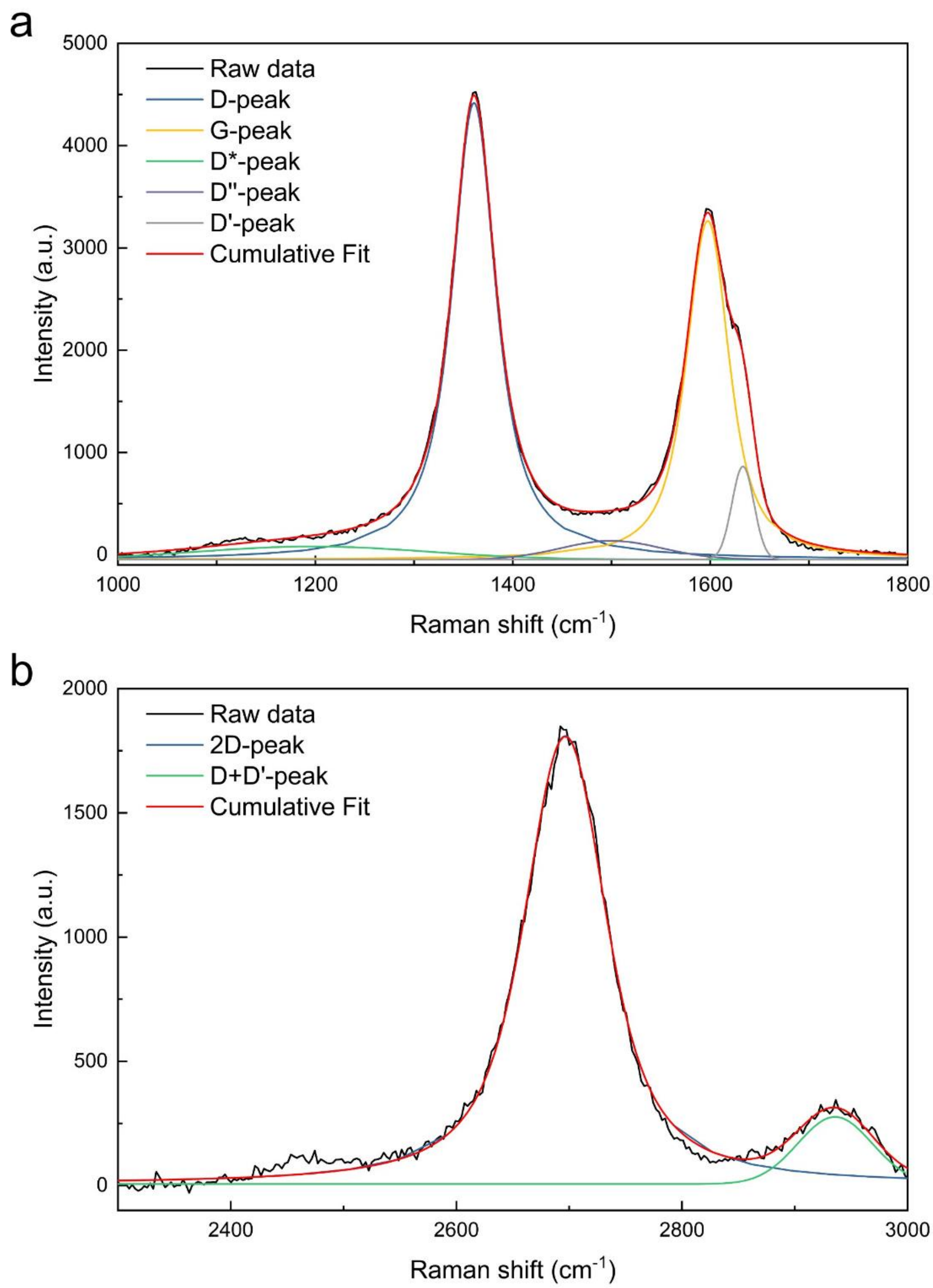


Figure S11: Exemplary Raman peak fits for pristine carbon felt.

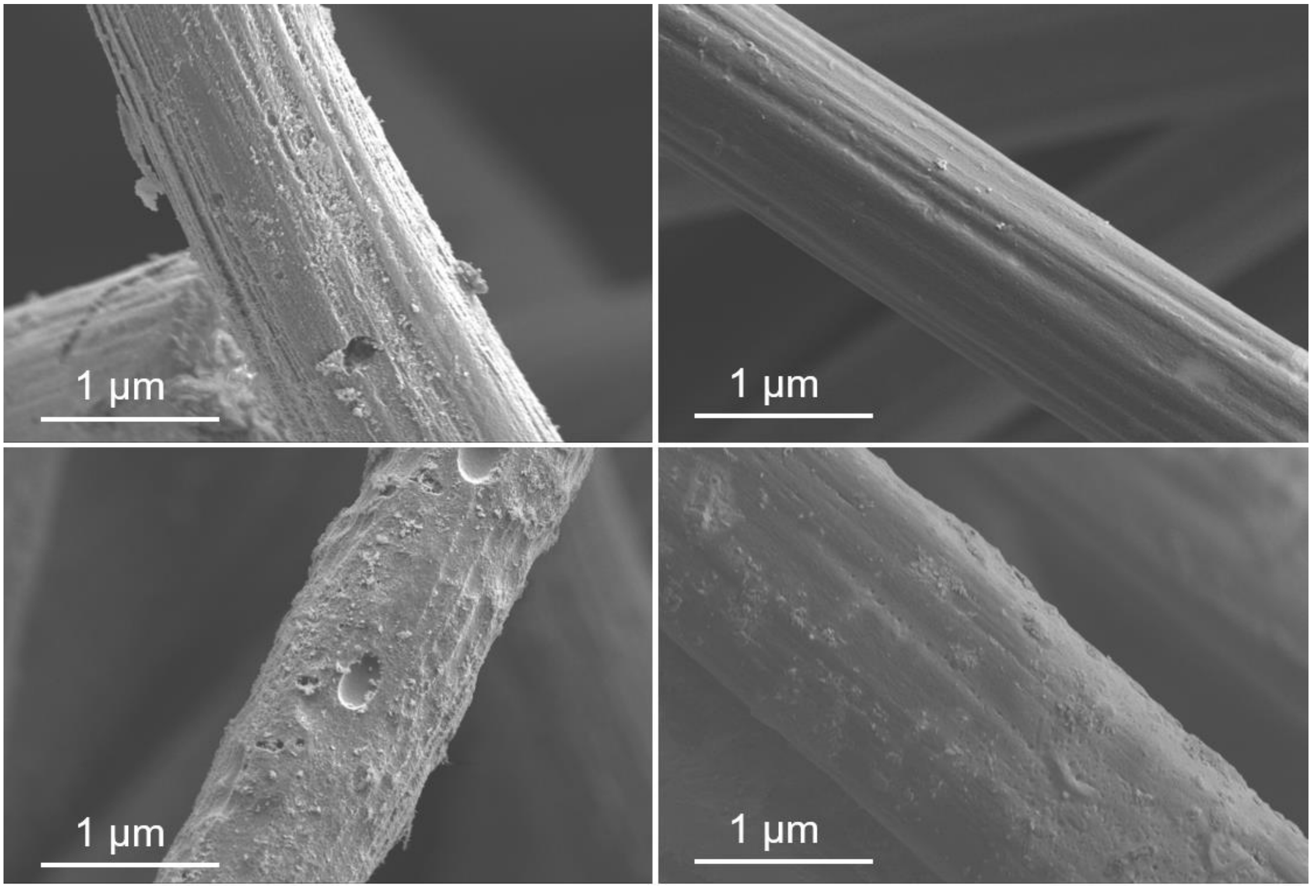


Figure S12: SEM: aged real positive (top left), aged artificial positive (top right), aged real re-activated positive (bottom left), and aged artificial re-activated positive (bottom right).

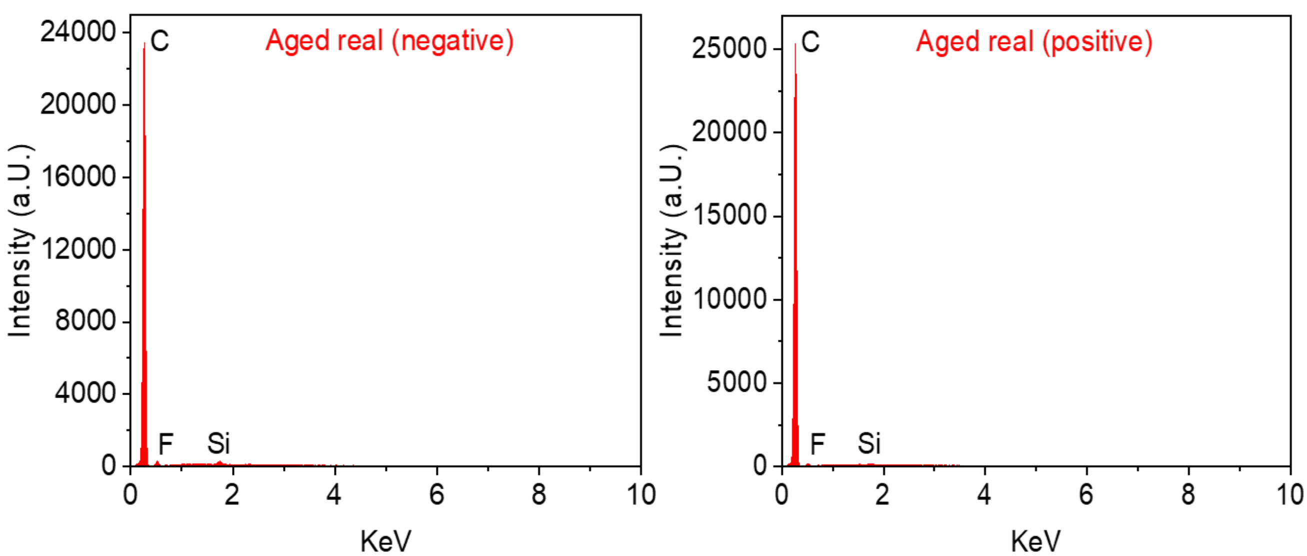
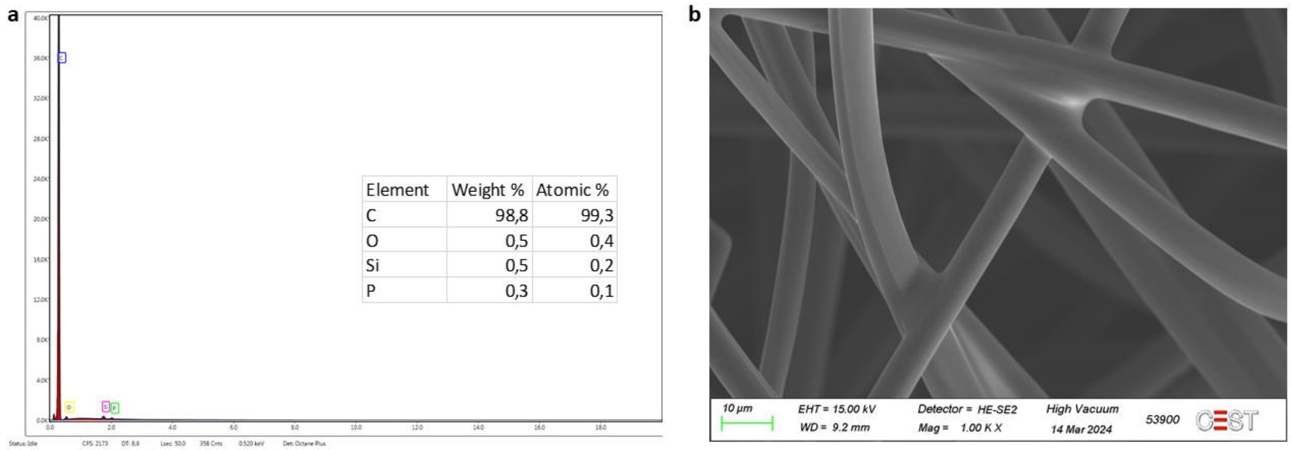


Figure S13: EDX: aged real negative (left), aged real positive (right). Determined Si concentrations: 0.2%.



Element	Weight %	Atomic %
C	98,8	99,3
O	0,5	0,4
Si	0,5	0,2
P	0,3	0,1

Figure S14: EDX (a) with inset of elements percentage in the carbon fibers of pristine felts impregnated with 0.5% wt Si and SEM (b) results.

The experiment involved impregnating pristine carbon felts with 0.5% weight of silicon to assess the impact of Si impurities on flow cell electrodes. The carbon felts were soaked in a solution of isopropanol and Silicon oil with a weight of 0.5% for an hour and then dried at 80°C for 40 minutes. After that, the felts were washed with DI water and dried again for 20 minutes. SEM-EDX was conducted, to confirm the presence of Si contaminations. The CV results in Figure S16 showed that the redox peaks were consistent with the pristine samples, indicating that there was no change in the structure and morphology of the felts that could affect the electrochemical performance, even at higher Si content.

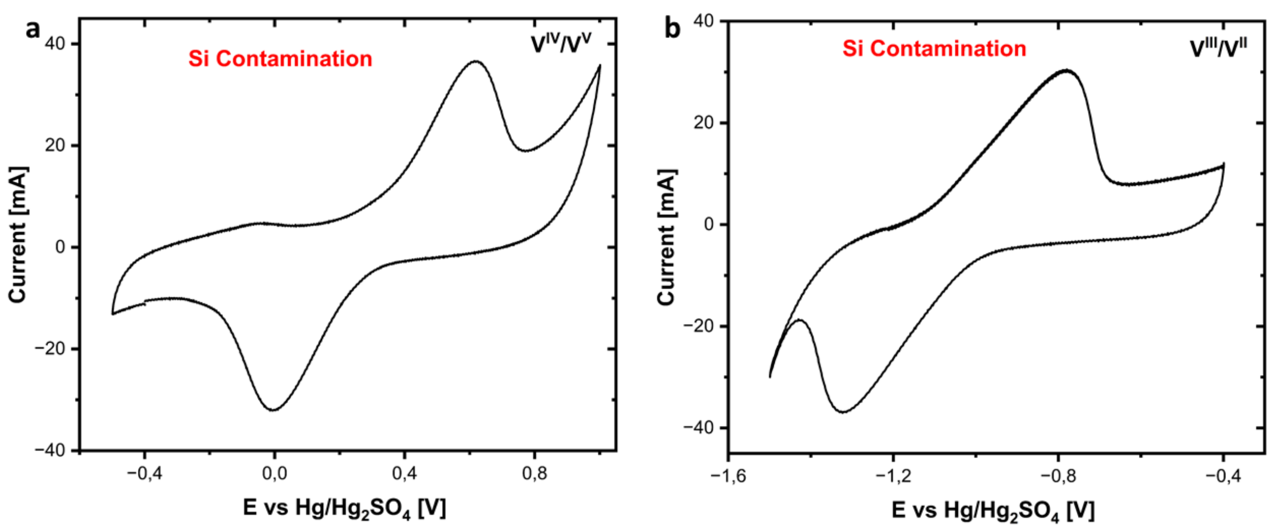


Figure S15: CV cycling for pristine felts contaminated with Silicon oil for the negative side(a), and positive side (b) reactions. Measured at a scan rate of 10 mV/s in an electrolyte of 15 mM $VOSO_4$. xH_2O dissolved in 2M H_2SO_4.

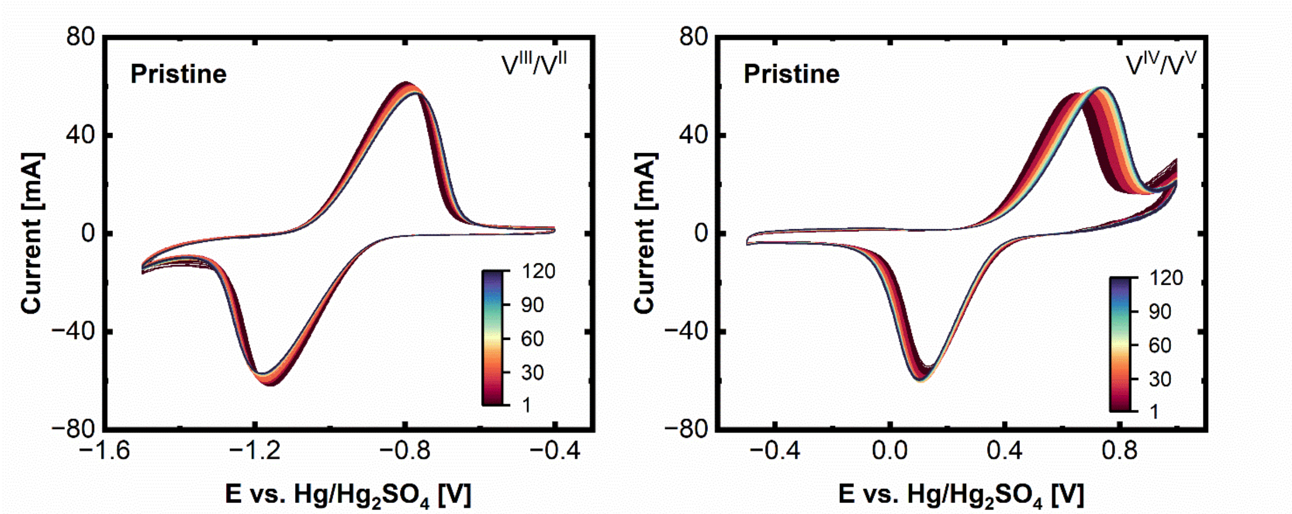


Figure S16: Long-term CV cycling: Pristine thermally activated felt negative (left) and positive (right).

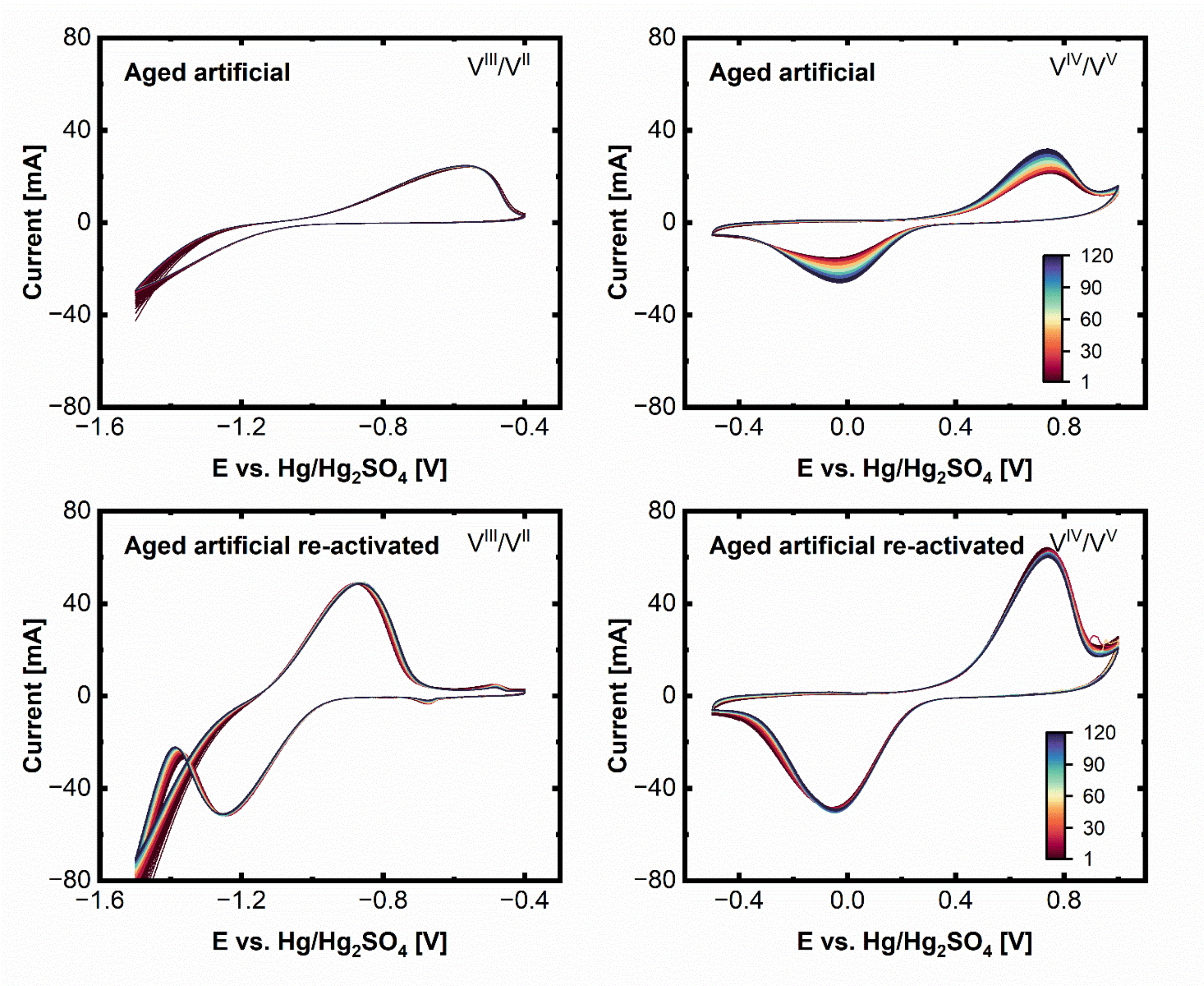


Figure S17: Long-term CV cycling: aged artificial negative (top left), aged artificial positive (top right), aged artificial re-activated negative (bottom left), aged artificial positive (bottom right). Beside the major redox couples indicated in the graphs, the minor peaks in "Aged artificial re-activated", can be attributed to the V^{III}/V^{IV} redox couple:

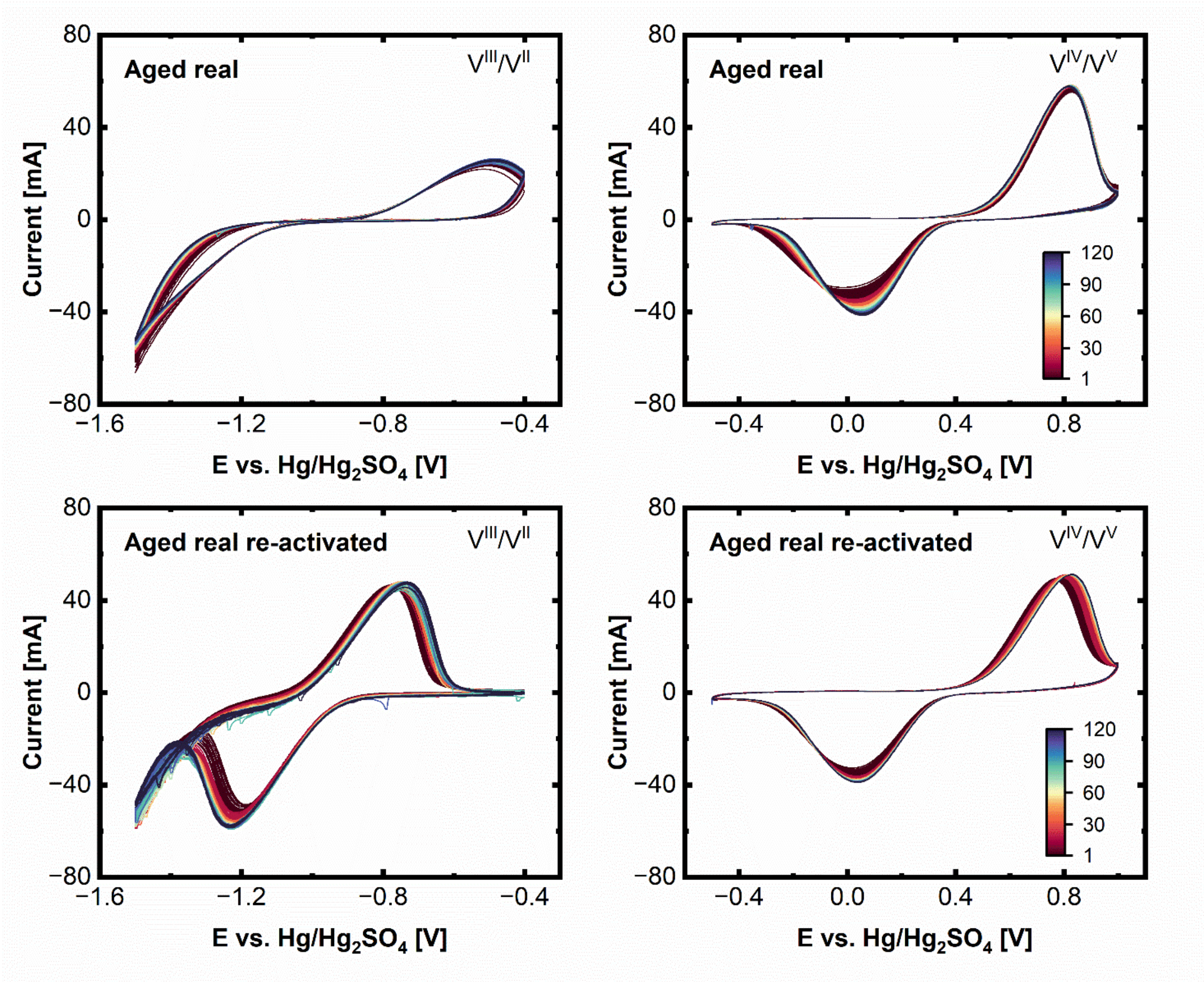


Figure S18: Long-term CV cycling: aged real negative (top left), aged real positive (top right), aged real re-activated negative (bottom left), aged real positive (bottom right).

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