Supporting Information

Impacts of Solvent Washing on the Electrochemical Remediation of Commercial End-of-Life Cathodes

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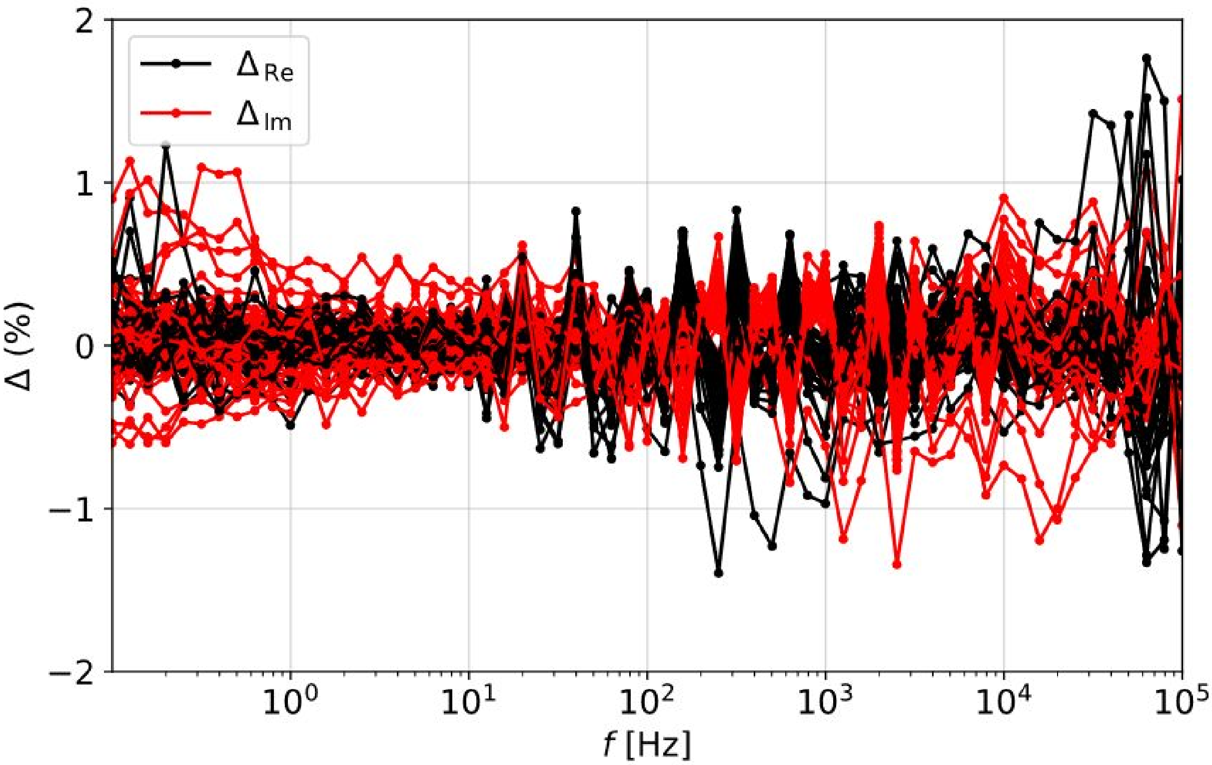


Figure S1. Lin-KK validity test residuals from all EIS measurements.

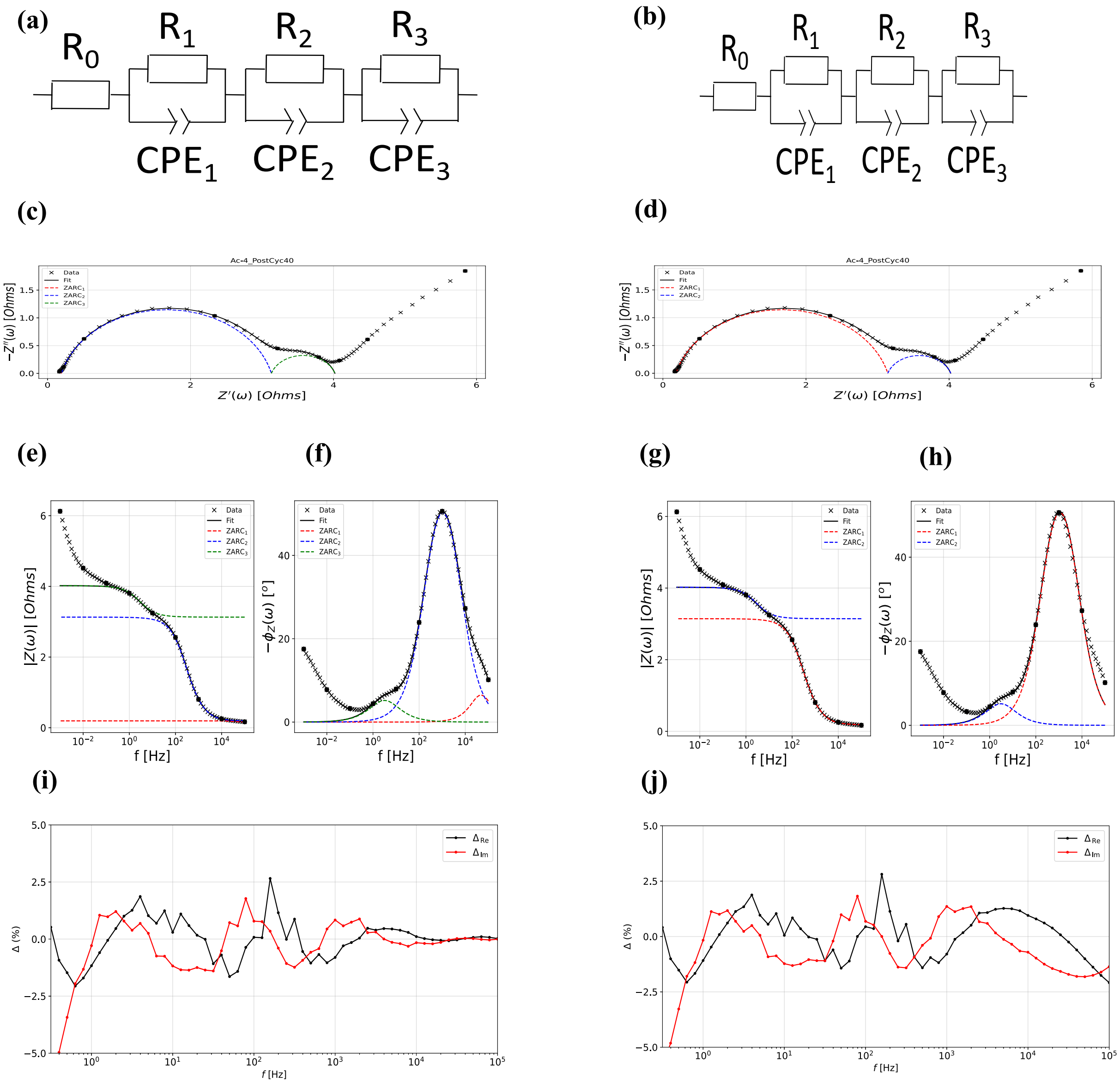
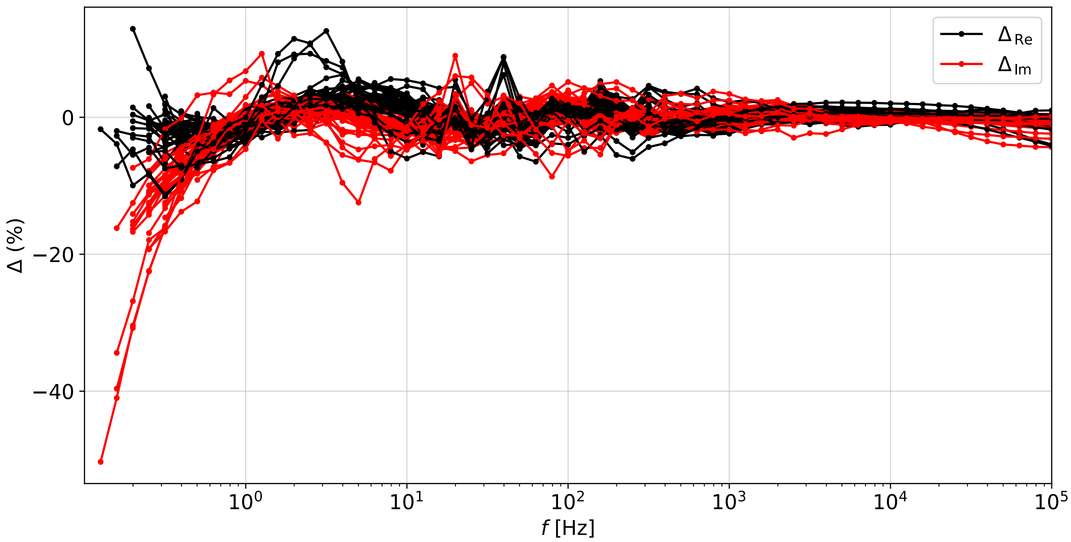


Figure S2. Comparison of equivalent circuit model fits with three ZARC elements (a) and two ZARC elements (b). Little difference is observed in Nyquist plots (c,d) for these examples, although some measurements show obvious misfit in the Nyquist plot when using two ZARCs, or three ZARCs with poor bounding on certain parameters. The impact of using three well-parameterized ZARCs is more obvious in the Bode absolute impedance (e,g) and phase (f,h) plots. Without three ZARCs, the impedance behavior at high frequencies (>10^4) cannot be fit, and attempting to reduce this error can also result in substantial misfit for the peak at ~10^3 Hz. Systematic error can be clearly observed when using two ZARCs versus three by comparison of the residuals plots (i,j) at frequencies >10^3.

(a)



(b)

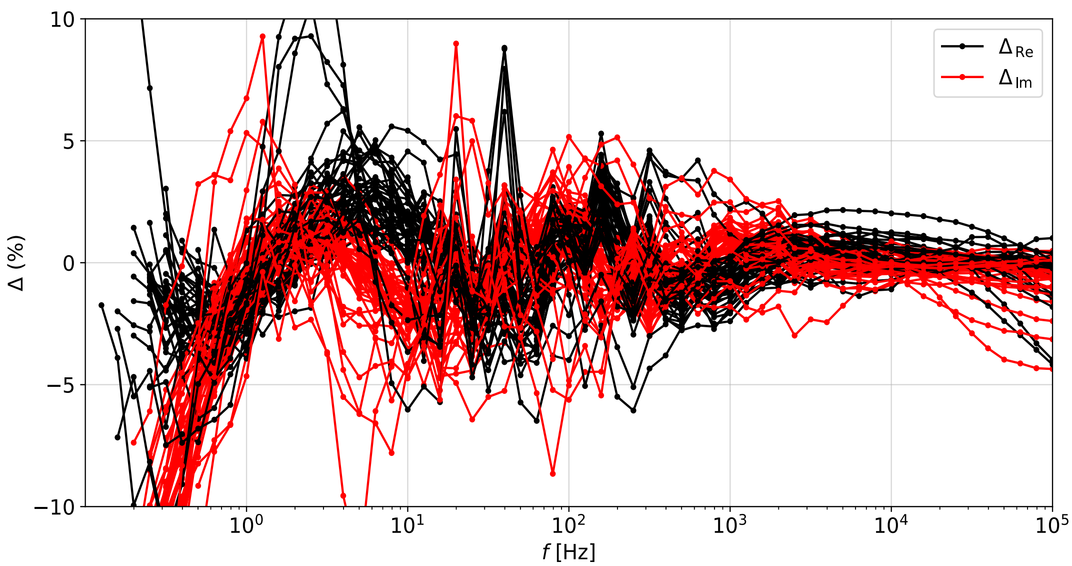


Figure S3. Residual errors of equivalent circuit model fits from all EIS measurements. (a) Errors modeling the imaginary component of impedance begin to diverge at lower frequencies because the equivalent circuit models were all fitted to truncated experimental data, so the fit data never approaches zero imaginary impedance, while the ZARC elements used for modeling must approach zero imaginary impedance as the frequency approaches zero. (b) Residuals plotted with the y-axis zoomed in shows sinusoidal error at frequencies lower than 10^3 Hz. Such systematic deviation suggests that the equivalent circuit model used is not accurately capturing all behaviors present in the EIS spectra. This systematic error could likely be removed by using a more complex model, such as a physically representative transmission line model; such analysis is beyond the scope of this work.

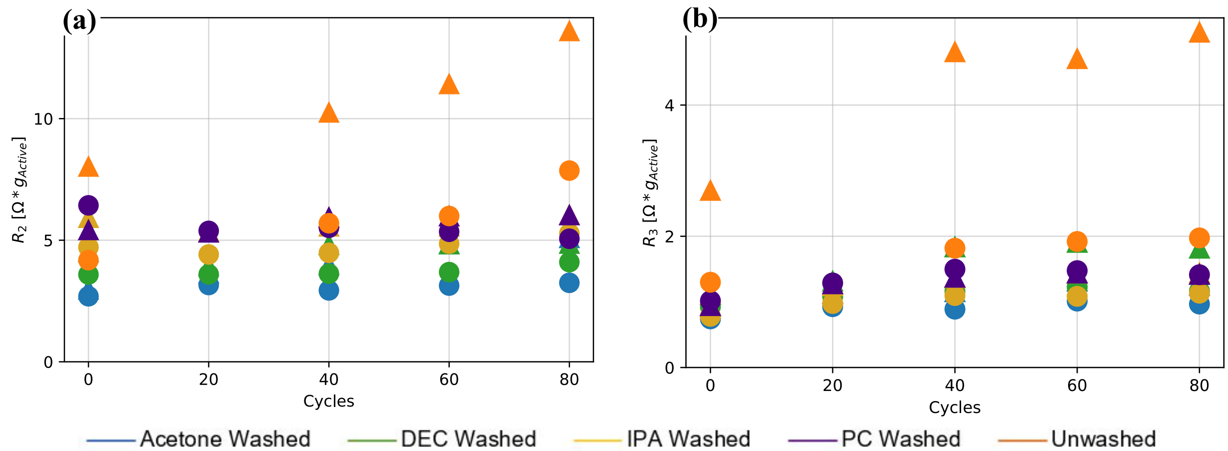


Figure S4. (a)-(b): Reproduction of Fig. 4 (c)-(d), respectively, including U-R samples.

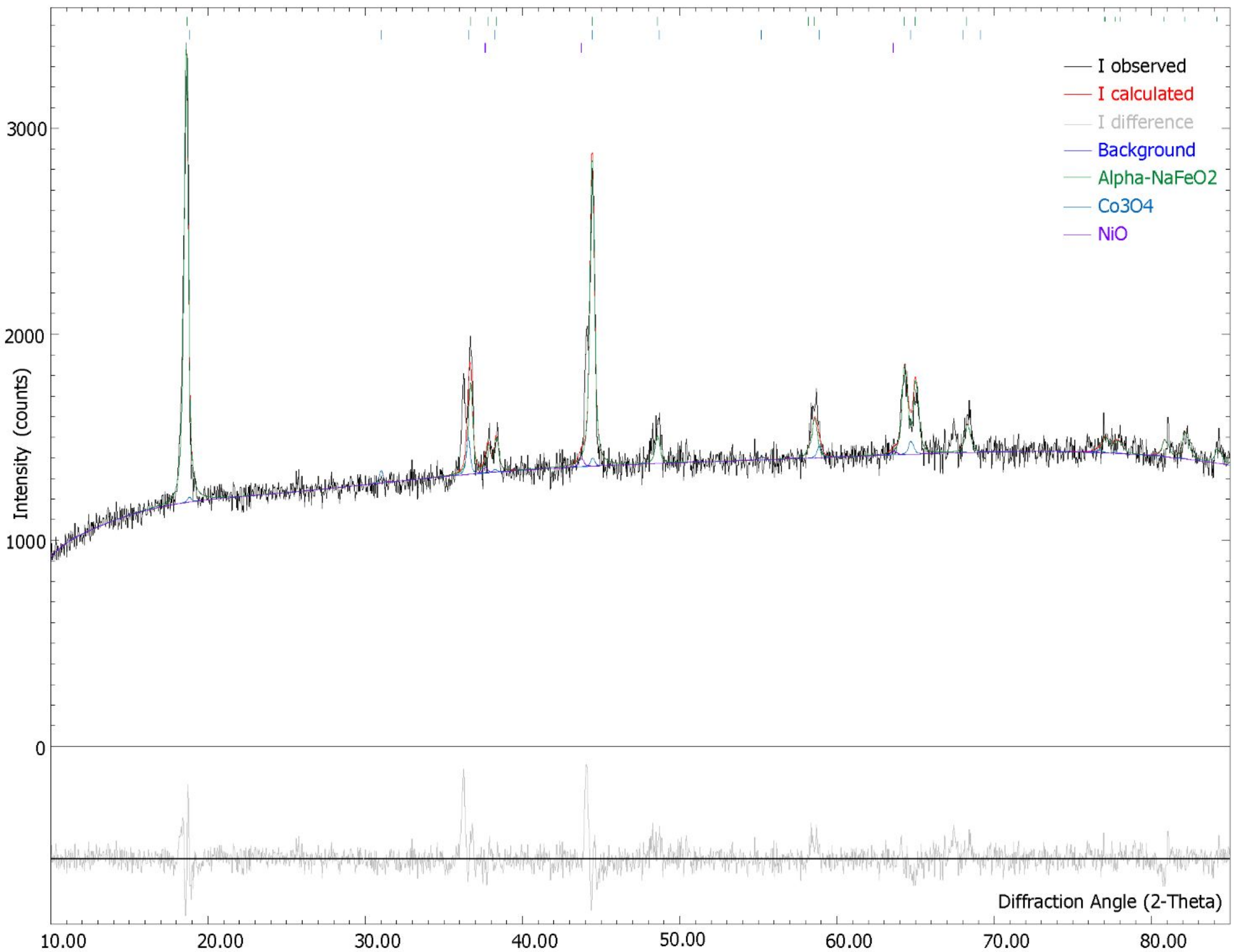


Figure S5. Representative XRD diffractogram of fresh NMC cathode material, showing α-$NaFeO_2$, Co_3O_4, and NiO phases. The presence of an additional, as-yet-unassigned phase is implied by the lower-angle splitting of the (101) peak and a lower-angle shoulder of the (104) peak. Observed, calculated, differences, and background intensities are displayed, and the hkl line positions for α-$NaFeO_2$ (top), Co_3O_4 (middle), and NiO (bottom).