batteries

MDPI

Supplemental Materials

Synthetic vs. Real Driving Cycles: A Comparison of Electric Vehicle Battery Degradation

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By examining the simulated C/35 discharge curves for the graphite/NCA system obtained from the half-cell data (Figure S1) and using the equations derived in a previous paper [4], the plating threshold condition was determined to be Equation (S1) where the loading ratio (*LR*) and total offset (*OFS*) were given by equations (S2) and (S3), respectively. LR_{ini} is the initial loading ratio of the un-aged cell and OFS_{ini} is the SOC_{PE} offset relative to the negative electrode due to the initial formation of the SEI layer.

$$100 \times LR + OFS = 100 \tag{S1}$$

$$LR = LR_{ini} \times \left(\frac{100 - \%LAM_{NE}}{100 - \%LAM_{PE}}\right) \tag{S2}$$

$$OFS = OFS_{ini} + LLI - \frac{LR}{LR_{ini}} \times \%LAM_{PE} \tag{S3}$$

By substituting Equations (S2) and (S3) into (S1) and rearranging, Equation (S4) was obtained.

$$LAM_{NE,PT} = 100 - \left[\left(\frac{100 - \%LAM_{PE}}{100 \times LR_{ini} - \%LAM_{PE}}\right) \times (100 - OFS_{ini} - \%LLI)\right] \tag{S4}$$

When LAM_{PE} is small, $\left(\frac{100-\%LAM_{PE}}{100\times LR_{ini}-\%LAM_{PE}}\right) \sim \left(\frac{100}{100\times LR_{ini}}\right)$. This approximation simplified (S4) into equation (1). For the complete dataset in this experiment, the maximum difference between the plating threshold values calculated from equations (S4) and (1) was 1.2.

$$LAM_{NE,PT} = \left(100 - \frac{100}{LR_{ini}} + \frac{OFS_{ini}}{LR_{ini}}\right) + \frac{\%LLI}{LR_{ini}} \tag{1}$$

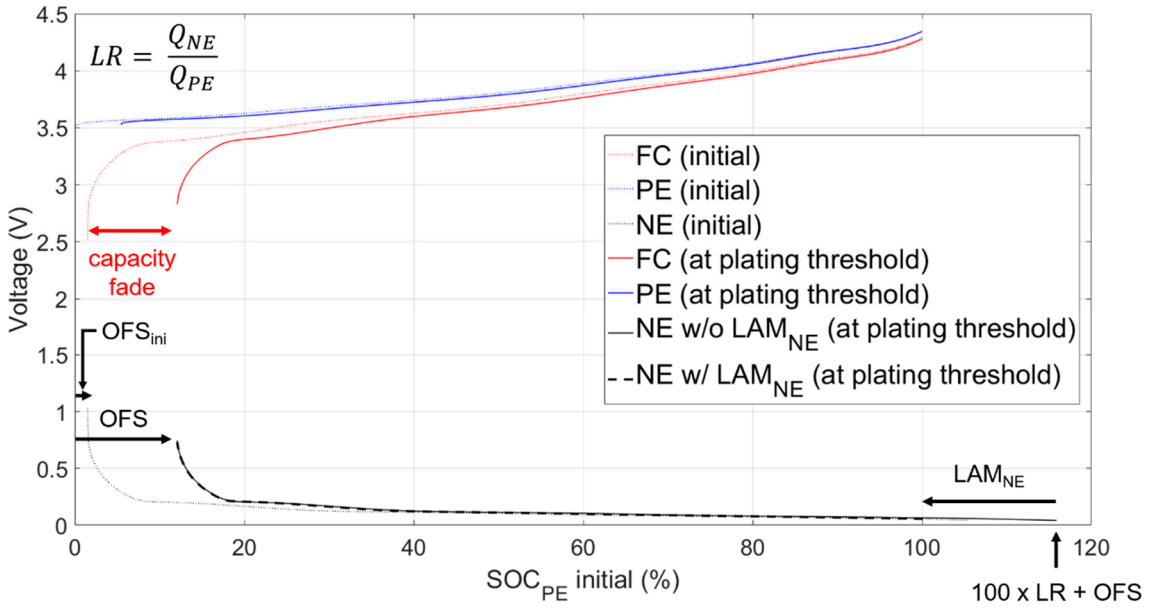

Figure S1. The *'alawa* simulation of the balance of the graphite/NCA electrodes after the formation of the initial SEI layer and at the plating threshold.