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Energy storage mechanism for hybrid battery JUN FENG, NATASHA CHERNOVA, FREDRICK OMENYA, ALOK RASTOGI, STANLEY WHITTINGHAM, Binghamton University — Many devices require both high energy and high power density, and lithium ion batteries and super-capacitors cannot separately always meet the requirements. In this work, we study the operating mechanism of a hybrid battery, which combines the best properties of batteries and supercapacitors. We analyze the lithium ion storage mechanism using XRD, Raman, TEM and electrochemical measurements. The model system studied combines a non-intercalating carbon black anode with a $LiFePO_4$ cathode. At 50% state of charge, XRD data for $LiFePO_4$ cathode material shows a mixture of $LiFePO_4$ and $FePO_4$, indicating battery reaction. On the other hand, the activated carbon remains structurally unchanged. We also discuss the impact of a range of activated carbon/ $LiFePO_4$ (AC/LFP) ratios. From cyclic voltammetry and charge/discharge results, the system exhibits battery-domain characteristics when the AC/ LFP ratio is below one, but showing more supercapacitor-domain traits when the ratio is higher. Besides, the systems have higher rate capacity at AC/LFP ratio around four as compared to one. This research is supported by NSF under Award Number 1318202.

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