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Self-Doped Conjugated Polymer as Binders for Lithium-ion Battery Cathode[1] XIAOYI LI, Rice Univ, HYOSUNG AN, JODIE LUTKENHAUS, Texas AM University, RAFAEL VERDUZCO, Rice Univ — Water-soluble, self-doped conjugated polymers have been reported to have good electrical conductivity, making them potentially strong candidates for energy storage and organic solar cell applications. In this work, two types of self-doped polymers with different pi-conjugated backbones were developed and studied systematically as organic multi-functional polymeric binders for V_2O_5 cathode in lithium-ion batteries: PFP with fluorene-phenol backbone, and PCPDTBTSO3K with cyclopenta-[2,1-b;3,4-b']-dithiophene-alt-4,7-(2,1,3-benzothiadiazole) backbone. A series of ex-stu thermal annealing experiment was carried out to investigate the structural impacts of incorporating self-doped polymers into V_2O_5 electrode at high temperature. X-ray powder diffraction (XRD) and grazing-incidence wide-angle x-ray scattering (GIWAXS) showed clear evidence that addition of only 5wt% polymer can suppress V_2O_5 crystallization up to 450C. Electrochemical tests of V_2O_5/polymer hybrid electrodes showed best capacity improvement at 250C (˜190 mAh/g for 5wt% PFP addition), alongside with enhancement in rate performance and charge-transport in thicker electrodes. Peel test was conducted with varying polymer content to show how these polymeric binders improve electrode adhesion.

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Xiaoyi Li
Rice Univ

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