Abstract Submitted
for the MAR15 Meeting of
The American Physical Society

**Flexible Hybrid Electrodes Containing Vanadium Pentoxide ($V_2O_5$) and an Electron- and Ion-Conducting Diblock Copolymer for Energy Storage** HYOSUNG AN, JARED MIKE, Texas A&M University, Chemical Engineering, KENDALL SMITH, LISA SWANK, YEN-HAO LIN, STACY PESEK, RAFAEL VERDUZCO, Rice University, Chemical and Biomolecular Engineering, JODIE LUTKENHAUS, Texas A&M University, Chemical Engineering — Vanadium pentoxide ($V_2O_5$) is a promising cathode material for Lithium-ion batteries due to its high capacity, high energy density, and cost-effectiveness. However, its low lithium-ion diffusion coefficient ($10^{-12}$ - $10^{-13}$ $cm^2/s$), low electronic conductivity ($10^{-2}$ - $10^{-3}$ S/cm), and severe volumetric changes during cycling have hindered its application in practical devices. One way to address these problems is to design hybrid electrodes that incorporate a second active material. For this purpose, poly(3-hexylthiophene)-*block*-poly(ethylene oxide) (P3HT-*b*-PEO) block copolymer containing electron- and ion-conducting polymer blocks was introduced to a $V_2O_5$ electrode system. Cathodes are prepared by mixing aqueous dispersions of block copolymer, $V_2O_5$, and lithium bis(trifluoromethanesulfonyl)imide (LiTFSI) and drop casting. The $V_2O_5$ and P3HT-*b*-PEO hybrid electrode showed synergistic results, having improved electrochemical storage performance and mechanical property. We also demonstrated a flexible battery prototype using the P3HT-*b*-PEO/$V_2O_5$ cathode.

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Date submitted: 13 Nov 2014 Electronic form version 1.4