**Materials Panel Abstract & Speaker Biography**

### Performance enhancing LbL coatings on separator for lithium-sulfur batteries

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Lithium-sulfur (Li-S) batteries have received a lot of attention since a pioneer report on sulfur as a cathode material for rechargeable batteries in 1979 [1]. Cathode and anode compositions were the core research focus of latest publications that aimed to mitigate unfavorable capacity loss in Li-S electrochemical cells. Meanwhile, the investigation scope of advanced battery separators as potential polysulfide shield was rather limited. Separator is a crucial battery component for insulating electrodes from each other and facilitating ion exchange through its porous structure. Alongside primary functions, separator is required to provide chemical stability under strong reducing and oxidizing conditions, to prevent short-circuit, exhibit high puncture strength, readily soak and retain electrolyte to ensure good ionic conductivity [2]. Commercial microporous polyolefin based separators offer excellent mechanical strength and chemical stability. However, they shrink, soften and even melt at high temperatures, which may cause short-circuiting of the electrodes in the case of unusual heat generation.

Thermal stability of a polyolefin based commercial separator was improved by deposition of a thin (~100 nm) (polyacrylic acid/clay/polyethyleneimine)$_n$ (PAA/clay/PEI)$_n$ coatings on its surface by the LbL technique, where clay is montmorillonite and halloysite. Investigation of surface properties of coated polyolefin separator revealed the formation of uniform, highly wettable and ion-conductive coating.

Meanwhile, the (PEI/MMT/PAA)$_{10}$ at pH 5 and (PEI/Hal/PAA)$_{10}$ at pH 2 tri-layer systems coatings demonstrate exceptional thermal and dimensional stability compared to uncoated separator and remarkably increases the coulombic efficiency of S/C cathode with high sulfur content from 50% for pristine polypropylene film to nearly 80% by preventing a shuttle effect of soluble products of the sulfur redox reaction. The cell performance enhancement is ascribed to a special structure of the coating and specific pH dependence of it's composition (consists of weak polyelectrolytes and clays). In summary, we have substantially improved the essential properties of separator, such as electrolyte uptake and thermal shrinkage. Abovementioned LbL assemblies serve as exceptionally good polysulfide diffusion barrier, and thereby restrained pronounced capacity diminution and raised the coulombic efficiency of lithium sulfur electrochemical cells.

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**References**

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Research Interests
High energy density ecologically friendly batteries for renewable energy storage, electric automobiles and portable electronics; Synthetic and biological molecules at interfaces; surface modification; self-assembly of macromolecules at surfaces; responsive polymer multilayers; surface spectroscopies; recyclable catalytic systems.

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