

The 53rd JUACEP Seminar

第53回 名古屋大学日米協働教育プログラムセミナー

Date: February 21 (Fri), 2020 15:00-16:30

Venue: Aerospace Meeting Room (Eng.Bldg-2, 3F 347)

航空会議室 (工学部2号館3F 347)

Lecturer: Prof. Richard M. Laine

Department of Materials Science and
Engineering, University of Michigan



Ion conducting polymers that emulate LiPON. Towards all solid-state batteries (ASBs)

The energy density of Li-ion technology could drastically increase by replacing the widely used graphite anode with metallic Li. Cycling lithium batteries containing liquid electrolytes often leads to uneven plating and stripping of metal on cycling that generates dendrites which could penetrate the polymer membranes used to separate anodes from cathodes. The resulting short-circuiting leads to cell failure prompting investigation of ceramic electrolytes thought to mechanically block dendrites from bridging. The search for ceramic electrolytes that offer Li^+ conductivities of 0.1-1 mS/cm has focused on LATP and c-LLZO. Unfortunately, LATP undergoes irreversible reduction of Ti^{4+} during cycling and c-LLZO is susceptible to Li dendrite penetration along grain boundaries. One solution has been to use very thin films (5-200 nm) of gas phase deposited, amorphous LiPON to block this behavior. Unfortunately, LiPON thin films offer Li^+ conductivities of 10^{-3} to 10^{-5} mS/cm that mandate the use of thin films. We have successfully synthesized LiPON-like polymers in an effort to explore their utility in the assembly of ASBs. We report here that these polymers show ambient conductivities of up to 1 mS/cm and can be used to assemble ASBs with sulfur cathodes and Li anodes that offer cyclability with energy densities of $\geq 750 \text{ mAh/g}_{\text{sulfur}}$ and 100 cycles at 0.5C with $> 90\%$ efficiency.

Biography: 1965-1969 B.S. Cum Laude in Chemistry, Calif. State Univ. at Northridge. 1969-1973 Ph.D., Univ. of Southern California. 1973-1974 Postdoc Fellow at Univ. of Delaware. 1974-1976 Postdoc Fellow at UC Santa Barbara. 1976-1987 Chemist, Senior Chemist, Program Director, Assoc. Director at SRI International. 1987-1990 Research Prof. at Washington Technology Center (WTC), Univ. of Washington. 1990-1999 Assoc. Prof., Dept. of MSE, Univ. of Michigan. 1999- Professor, Dept. of MSE, Univ. of Michigan. 2003 Founded Mayaterials Inc. 2006-2015 Director, Macromolecular Science and Engineering Center.

Inquiry: JUACEP Office 日米協働教育プログラム (Ext. 2799)

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