Rethinking the design of solid-state electrolytes

Shou-Hang Bo

Affiliation: University of Michigan – Shanghai Jiao Tong University Joint Institute,

College of Chemistry and Chemical Engineering, Shanghai Jiao Tong University

Email: shouhang.bo@sjtu.edu.cn

Abstract: The high efficiency and stable cycling of solid-state batteries place stringent requirements on the solid electrolyte's ionic conductivity, electronic conductivity, and electrochemical stability. However, the transport of ions in solids (such as ceramics or ceramic polymer composites) is usually slow. It is, therefore, particularly important to understand how ions move in solids and to further extract design principles for new solid electrolytes with improved ionic conductivity. In this talk, we will first introduce the Meyer-Neldel-conductivity plot, and then explain the obtained design guidelines for solid-state electrolytes from this plot. We show that a low migration barrier is not always beneficial for high ionic conductivity. Instead, in some materials, high migration barriers can lead to high ionic conductivity. Furthermore, we proposed the so-called crystallinity-conductivity-correlation equation to guide the development of ceramic-polymer composite solid electrolytes. Finally, we will show several new solid electrolytes and discuss their potential applications in solid-state batteries.

References:

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Biography:

Dr. Shou-Hang Bo is currently an associate professor of materials science and engineering at the University of Michigan-Shanghai Jiao Tong University Joint Institute, and an adjunct associate professor at the college of chemistry and chemical engineering, Shanghai Jiao Tong University. Before joining Shanghai Jiao Tong University in 2017, Dr. Bo obtained his B. S. and Ph. D. degree in Chemistry from Fudan University (2009) and Stony Brook University (2014), respectively. He was a postdoctoral associate at Massachusetts Institute of Technology and Lawrence Berkeley National Laboratory from 2014 to 2017. His research interests include solid-state electrolytes, interfaces and imaging of solid-state batteries. In recognition of his scientific contribution to solid-state batteries, Prof. Bo was selected into the Finalists in Energy for the 2017 World Technology Award, and received the Next-Generation Battery Technology Award in 2020. He also received the “Tang Lixin Distinguished Teacher Award” from Shanghai Jiao Tong University in 2020.