

# 7<sup>th</sup> Kyushu University Platform of Inter/Transdisciplinary Energy Research (Q-PIT) Seminar

## 36<sup>th</sup> INAMORI Frontier Research Center Seminar

**Title**            **Understanding solid ionic conduction on the route to solid-state batteries**

**Speaker**       **Dr. Wolfgang Zeier**  
**Institute of Physical Chemistry,**  
**Justus-Liebig-University Giessen, Germany**

**When**           **November 26th, 2018, 16:00~17:00**

**Location**      **INAMORI Center, Seminar Room on the 2<sup>nd</sup> floor**



### Abstract

The advent of solid-state batteries has spawned a recent increase in interest in lithium conducting solid electrolytes, especially in the lithium thiophosphates. These materials are intrinsically soft in nature, which has always been believed to be beneficial for ionic transport. It is usually assumed that ion transport comes with lower activation barriers in softer, more polarizable lattices. Within a more polarizable lattice the anions can displace easier and the energetic cost for a moving ion is much smaller. This chemical intuition has been corroborated by the good conduction in materials with iodine or sulfide anions, compared to the stiffer and less polarizable oxides.

In this presentation, we will discuss some of our approaches to understand the underlying structures of some ionic conductors and optimizing their ionic conductivities in order to identify an ideal solid electrolyte for SSBs. Further, we will show how tuning the lattice polarizability in ionic conductors affects the ionic transport due to a softening of the lattice. Our work shows that the idea of “the softer, the better” needs to be revisited. Lastly, we show how volume changes, induced by electrochemical (de-)intercalation, affect the performance in solid state batteries providing an understanding of the underlying mechanochemical influences in solid-state batteries.

### Short-bio

Dr. Zeier conducted his graduate studies in the field of thermoelectrics as a joint student of Prof. Jeffrey Snyder (California Institute of Technology) and Prof. Wolfgang Tremel at the Johannes Gutenberg-University in Mainz, where he received his Ph.D. in 2013. After two postdoctoral stays at both the University of Southern California (Prof. Brent Melot) with a focus on lithium conducting solid electrolytes and at the California Institute of Technology (Prof. Jeffrey Snyder) he was appointed junior group leader at the Justus-Liebig-University in Giessen. His research interests encompass the fundamental structure-to-property relationships in solids, with a focus on thermoelectric and ion-conducting materials, as well as solid-solid interfacial chemistry for all-solid-state batteries.

### Contact

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