Ionic Conductors: Characterisation of Defect Structure

Professor Isaac Abrahams
Queen Mary, University of London

Aims
This course introduces students to basic crystal structures and explains how presence of defects leads to materials that support high ionic conductivity. The concepts of crystal chemistry, the relationships between structures as well as methods of defect structure analysis are covered.

Lectures
- Introduction to crystal chemistry: 25 February, Friday 11:15-14:00 room 309
- Defects in crystalline solids: 2 March, Wednesday 14:15-16:00 room 113
- Fast ion conduction in crystalline solids: 7 March, Monday 16:15-19:00 room 309
- Fast ion conduction in amorphous solids: 9 March, Wednesday 14:15-16:00 room 113
- Structure-conductivity relationships: 16 March, Wednesday 14:15-16:00 room 113
- Defect structure analysis by neutron diffraction: 23 March, Wednesday 14:15-16:00 room 113
- Total scattering analysis: 28 March, Monday 16:15-18:00 room 309

Workshops
- Basic crystal structures and their relationships: 4 March, Friday 11:15-14:00 room 309
- Defects, dislocations and defect clusters: 11 March, Friday 11:15-14:00 room 309
- Fluorites structure and conductivity: 18 March, Friday 11:15-14:00 room 309
- Phase transitions in solid electrolytes: 21 March, Monday 16:15-19:00 room 309
- Defect structure analysis from powder neutron data: 25 March, Friday 11:15-14:00 room 309

Learning Outcomes
By the end of this course students should be able to:
- Describe the most important inorganic crystal structures in terms of close packing of ions and explain the relationships between these structures.
- Describe the main types of defects that occur in crystalline solids, how these defects are formed and how they can move within the solid.
- Describe the main structures that act as hosts for fast ion conduction.
- Describe the main features of solid electrolytes, including cation and anion conducting systems and the main types of conduction mechanisms in these systems.
- Understand the different types of phase transitions that occur in solid electrolytes and the structure-property relationships in these systems.
- Carry out a basic defect structure analysis of a solid electrolyte using neutron diffraction data.