Chemistry Departmental Seminar

Dr Karen Johnston

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Thursday 16th January

4.00 pm, Physics Lecture Theatre, Science Concourse

‘Probing Ion Mobility Mechanisms in Solid Electrolytes using Solid-State NMR’

The rechargeable lithium-ion battery is considered the technology of choice for energy storage in a wide array of electronic devices. However, it’s application is limited by its use of liquid electrolytes, which pose a fire and safety risk. As a result, there has been considerable investment in the development of all-solid-state batteries and solid electrolyte materials. We will discuss three potential solid electrolyte systems; lithium-rich anti-perovskites (LiRAPs), Li-stuffed garnets and spinels. We will demonstrate how solid-state NMR can be used to probe both the local structure and ion mobility within each system, via conventional and two-dimensional techniques, and T_1 relaxation measurements. We will explore the effects of hydration within LiRAPs and how solid-state NMR can be used to identify conduction pathways and mechanisms. Compositional changes will also be explored to determine their effects on local structure and conductivity. To gain a comprehensive understanding of structure and ion mobility, experimental techniques have been used in conjunction with *ab initio* molecular dynamics (AIMD) calculations.

Biography

Karen Johnston obtained both her BSc and PhD from the University of St Andrews. During her PhD, she focused on the synthesis and structural characterisation of novel perovskite-based materials using a combination of powder diffraction, solid-state NMR spectroscopy and density functional theory calculations. Following her PhD, she undertook postdoctoral work at the University of Windsor (Canada), where she concentrated on the development of wideline NMR methods. In 2013 she moved to ALISTORE-ERI (Nantes, Cambridge) where she worked on the development of ternary alloys for use as negative electrodes in Li-ion batteries. Karen was appointed Assistant Professor in Inorganic Chemistry at Durham University in 2015, where she has been concentrating on the design and development of new solid electrolyte materials for all-solid-state batteries. In particular, her work has focused on probing local structural changes and assessing their influence on the observed physical properties, including the ionic conductivity.