Queensland Micro- and Nanotechnology Centre

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Speaker: [Dr Claudio Cazorla]
School of Materials Science and Engineering
University of New South Wales
Sydney

Date: Tuesday 29 January 2019

Time: 11.00 am

Venue: Science 2 building (N34) Room 0.04, Nathan Campus

Title: **Giant Caloric Effects in Fast-ion Conductors: A Promising Route Towards Ambient Solid-State Cooling**

Abstract

Solid-state cooling is a sustainable and energy efficient refrigerant technology that exploits field-induced reversible transformations in materials. Solid-state cooling is a promising alternative to traditional refrigeration technologies based on compression cycles of greenhouse gases, which in addition to their obvious environmental threats cannot be scaled to small sizes (eg. microchip dimensions). Nevertheless, most caloric materials known to date (ferroelastic, ferroelectric, and magnetic compounds) display only modest refrigeration performances and/or operate at temperatures far from ambient. Recently, we have predicted by means of classical and quantum simulation methods that giant caloric effects occur in fastion conductors[1-3], a class of materials with high ionic conductivity below their fusion points that commonly are exploited in electro-chemical devices. The giant caloric effects disclosed in fast-ion conductors can be understood in terms of field-driven changes on their ionic conductivity, which are highly reversible and responsive. A giant cooling effect of ~20K has been just measured directly in the archetypal superionic compound AgI[4]. We argue that solid-state cooling could benefit immensely from the intensive research already undertaken on solid-sate batteries and oxide fuel cells.

References

[1] C. Cazorla and D. Errandonea, Nano Letters 16, 3124 (2016)
[2] A. K. Sagotra, D. Errandonea, and C. Cazorla, Nature Communications 8, 963 (2017)
[3] A. K. Sagotra, D. Chu, and C. Cazorla, Nature Communications 9, 3337 (2018)
[4] A. Aznar, P. Lloveras, C. Cazorla et al., Nature Communications 8, 1851 (2017)

Brief Biography

Dr. Cazorla was awarded his doctorate in Computational Physics by the Polytechnic University of Catalonia (Barcelona, Spain) in 2006. From 2006 to 2010, Dr. Cazorla worked as a postdoctoral researcher in the group of Prof. Michael Gillan and Prof. Dario Alfe at the University College London (London, United Kingdom). In 2010, Dr. Cazorla moved to the Institute of Materials Science of Barcelona (Barcelona, Spain) as a JAE-DOC Fellow. From 2015 to present, Dr. Cazorla is an ARC Future Fellow at the School of Materials Science and Engineering in UNSW Sydney. His primary research interest is the application and development of computational techniques to understand and predict new oxide-based and inorganic materials for nanoelectronics and energy related applications.

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