ChE SEMINAR

Chemistry at the edge: perovskite exsolutions

John Thomas Sirr Irvine
School of Chemistry
University of St Andrews
St Andrews
Fife KY16 9ST, United Kingdom.
http://ch-www.st-andrews.ac.uk/staff/jtsi/group/group/index.html

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ABSTRACT

Metal particles supported on oxide surfaces promote many of the reactions and processes that underpin the global chemical industry and are key to many emergent clean energy technologies. At present, particles are generally prepared by deposition or assembly methods which, although versatile, usually offer limited control over several key particle characteristics, including size, coverage, and especially metal-surface linkage. Here metal particles are grown directly from the oxide support though in situ redox exsolution. We demonstrate that by understanding and manipulating the surface chemistry of an oxide support with adequately designed bulk (non)stoichiometry, one can control the size, distribution and surface coverage of produced particles. We also reveal that exsolved particles are generally epitaxially socketed in the parent perovskite which appears to be the underlying origin of their remarkable stability, including unique resistance of Ni particles to hydrocarbon coking, whilst retaining catalytic activity.

ABOUT THE SPEAKER

John Irvine is Professor of Chemistry at the University of St Andrews and currently holds a Royal Society Wolfson Merit Award. His first degree is in Chemical Physics from Edinburgh University and he obtained a DPhil from the University of Ulster in Photoelectrochemistry. He performed his postdoctoral studies working with Anthony West in Aberdeen and was subsequently appointed to a BP/RSE fellowship, lectureship and senior lectureship at Aberdeen University. In 1999 he moved to the University of St Andrews as Reader and then Professor of Inorganic Chemistry.

In 2005, he was elected as a Fellow of the Royal Society of Edinburgh and in 2013, Fellow of the Royal Society of Chemistry. Irvine led the European Science Foundation Programme on the Optimisation of Solid State Electrochemical Processes for the Oxidation of Hydrocarbons as well as two EU Research Training Networks on protonics and SOFC anodes. Irvine is a European Councillor of the International Society for Solid State Ionics and is on the Editorial Board for Journal of Materials Chemistry. He is currently a member of the DeTao Maters Academy, Guest Professor at Hefei University of Technology, Beijing and a Visiting Professor at Robert Gordon University, Aberdeen.

His research interests are in solid state ionics, new materials, ceramic processing, electrochemistry, fuel cell technology, hydrogen, photoelectrochemistry, electrochemical conversion and heterogeneous catalysis. He has around 380 publications in refereed scientific journals.