

Hydrothermal Synthesis of Precious-Metal Oxides: New Chemistry and New Materials

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Abstract in english

The use of solvothermal synthesis has been well developed over the past few decades for the preparation of oxide phases, particularly when water is used as solvent. By using mild solution-mediated crystallisation, control of crystal form may be possible to form crystallites with nanoscale dimensions: this provides a means of controlling materials' properties beyond the crystal chemistry. There is therefore much scope for developing solvothermal synthesis for discovery of new functional materials with interesting physical properties, and in this presentation I will describe some novel approaches to preparing mixed-oxides using hydrothermal chemistry. In particular we have studied the chemistry of ruthenium and iridium and discovered a range of new materials in which we are able to stabilise high oxidation states of the metals; this includes a novel layered ruthenate $\text{SrRu}^{\text{V}}_2\text{O}_6$ with unusually high antiferromagnetic ordering temperature ($> 200\text{ }^\circ\text{C}$), new structure types in $\text{Ba}_2\text{Ru}^{\text{V}}_3\text{O}_9(\text{OH})$ and $\text{Ca}_2\text{Ir}^{\text{IV}}\text{F}(\text{OH})_6\cdot\text{OH}$ and some novel mixed pyrochlores $(\text{Na}_{0.33}\text{Ce}_{0.67})_2(\text{Ir}_{1-x}\text{Ru}_x)_2\text{O}_7$. One application of such precious-metal oxides is in electrocatalysis in aqueous acid electrolytes and we have been able to fabricate robust electrode coatings for PEM fuel cell applications.

Short Bio/CV



Richard Walton was educated at the University of Oxford (BA 1994) and the University of Reading (PhD 1997) and undertook postdoctoral work in the Inorganic Chemistry Laboratory, Oxford. Following an academic position at the University of Exeter (2000-2005) he was appointed at the University of Warwick as Senior Lecturer in 2006 and promoted to Professor of Chemistry in 2011. His research focusses on the synthesis and characterisation of a range of inorganic materials (particularly using synchrotron X-rays and neutron scattering), and industrial collaboration to examine their application in areas such as catalysis and electrochemistry. He is co-editor (with Bruce and O'Hare) of the *Inorganic Materials Series*, published by Wiley (2010-).