Electrochemical Synthesis of Amorphous Materials for Water Splitting

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Aligned with Science Focus: methanol or hydrogen economy, renewable energy storage

Abstract:

The ability to store energy from intermittent renewable energy sources is a significant challenge that can be addressed by generating hydrogen as a fuel via electrochemical water splitting. To ensure the commercial penetration of electrolysers to produce hydrogen at scale, there is an urgent need to develop new cost-effective catalyst materials that are active yet stable. There has been a significant research effort in this area for both the hydrogen evolution reaction at the cathode and the more sluggish oxygen evolution reaction at the anode where the latter limits the overall efficiency of an electrolysis cell. These efforts have focused on replacing expensive materials such as Pt, RuO_2 and IrO_2 with more earth abundant materials based on metal chalcogenides and selenides for hydrogen evolution and iron, cobalt and nickel oxides for oxygen evolution.

In this talk I will summarise our recent work on the electrochemical fabrication of amorphous electrocatalysts such as cobalt sulphide and phosphide for hydrogen evolution and homogeneously mixed metal oxides based on Fe, Co and Ni for oxygen evolution. It is shown that these materials are easy to produce as thin films on a variety of support materials which are both active and stable. The advantages of an electrochemical approach is that it is simple, rapid and can be undertaken at ambient conditions which ensures commercial viability and ultimately is scalable. The latter is highly important if large scale electrolysers are to be produced that can store electricity as hydrogen that is produced by wind or solar farms.

Biographical Statement of speaker:

A/Prof. Anthony O'Mullane is currently leader of the Manufacturing with Advanced Materials platform within the Institute of Future Environments, QUT. He is a fellow of the RACI and RSC and associate editor of RSC Advances. He has published over 120 papers in the area of electrochemistry and materials science.

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