Generating high purity nanoparticles via transfer arc plasma

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Career Level: Early Career Scientist (<5 yrs post PhD)

Aligned with Science Focus: general catalysed processes

Abstract:

In this work, we present a plasma-based technique to generate inorganic nanoparticles. To date, inorganic nanoparticle fabrication is dominated through traditional chemical processes. Despite their ability to generate a plethora of nanoparticles, their formulation can be constrained by non-uniformity, low yield, the incorporation of impurities, and formation kinetics. These limitations often curtail the properties exhibited by the nanoparticles, thereby reducing their usefulness. In our method, we created nanoparticles by instantaneously vaporising and quenching materials in a controllable atmosphere. The instantaneous nature of the process allows the formation of ultra-fine nanoparticles (<10 nm) and the controllability of the atmosphere ensures purity of the resulting material. By carrying out material characterisations, we show that we can generate nanoparticles not only in high yield but also with control over their compositions, morphologies and crystallinities. In order to demonstrate the viability of our material for a range of applications, we generated both titanium nitride and nickel-based nanoparticles. These materials were then investigated in the areas of energy storage, catalysis and photocatalysis. From these results, we demonstrates that our materials provides significant benefits to their traditionally derived counterparts.

Biographical Statement of speaker:

Samuel Yick is a postdoctoral research fellow from CSIRO. He completed a BSc in Nanotechnology from the University of New South Wales and obtained his doctorate degree from University of Sydney based on his research in carbon nanomaterials. His main research interest is in nanomaterials, especially on their synthesis and applications. Currently, his main research topic is in the catalytic breakdown of biomass for waste valormisation. In addition to this, he also works on energy storage devices and implantable devices. Samuel is passionate about science communication and is involved with various STEM programs to encourage student's passion for science.

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