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Carbon-based hybrid nanostructures for energy storage applications

Transition metal oxides such as MnO_2 and RuO_2 are promising materials for achieving both high power and energy densities in energy storage devices. However, it remains a great challenge to develop these metal oxides-based high-performance electrodes due to their low electrical conductance and poor stability. At CSIRO, we have studied a number of metal oxides such as mixed-valent MnO_2 nanoparticles, MnO_2 nanowires, and RuO_2 Nano films, and combined them with carbon-based nanostructures including graphite films and graphene, to fabricate Nano hybrids in synergistic integration. We demonstrated controlled size, density, composition and morphology of the metal oxides, and developed several approaches such as plasma and electrochemical surface treatments to effectively improve the interfacial adhesion between metal oxides and carbon supports. The Nano hybrids show both high specific capacitance and superior stability, which may open up new opportunities in areas such as lithium ion batteries, super capacitors, catalysts, photosynthesis, and electrochemical sensors.

Biography

Zhao Jun Han is the Senior Research Scientist at CSIRO. He was Research Scientist (2012-2015) and the Office of Chief Executive Postdoctoral Fellow (2009-2012). He graduated from Nanyang Technological University, Singapore, with both BEng and PhD degrees in Electrical and Electronic Engineering. He is the recipient of CSIRO's Julius Career Award (2014), Australian Research Council's DECRA fellowship (2013), and the Institute of Engineering Singapore Award (2007). His research topics include the synthesis and application of carbon Nanomaterial's, energy storage devices, water purification, and biomedical engineering.

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