

Architectural and Structural Designs of Mo-CeO_{2-x} Heterostructures To Achieve High Theoretical Capacitance

Monday, 2 December 2019 11:00 (20 minutes)

Tailoring the nanostructure of a supercapacitor with desired functionality necessitates both architectural and structural designs. Ultrathin two-dimensional architecture has emerged as one of the most promising candidates owing to the advantage of short diffusion pathways. Moreover, structural modifications through creation of exposed defects at the electrolyte intersection would maximise the charge storage performance. In this work, architecturally and structurally designed free-standing 2D CeO_{2-x}, with ultrahigh surface area of 270 m²/g with volumetric oxygen vacancy was fabricated on nickel foam using chronoamperometric electrodeposition. The novel 2D CeO_{2-x} were assessed for pseudocapacitive performance revealing an extremely high value of 582 F/g (scan rate 1 mV/s) that exceeds the theoretical capacitance of CeO₂ (562 F/g). Further structural optimisation was conducted by implantation of molybdenum (Mo) at different fluences on the CeO_{2-x} resulting in Mo-CeO_{2-x} hybrid nanostructure. This unique nanostructure exhibited enhanced gravimetric capacitance of 746 F/g with high charge/discharge stability of 98% after 2500 cycles. In addition, ab-initio DFT and ex-situ XPS results revealed the role of oxygen vacancies in enhancing the capacitance of CeO_{2-x}, thereby revealing a new mechanism route for dual-valence metal oxides.

Level of Expertise

Experienced Researcher

Do you wish to take part in the poster slam

No

Travel Funding

No

Speakers Gender

Male

Primary authors: Dr MOFARAH, Sajjad Seifi (School of Materials Science and Engineering UNSW Sydney); Dr KOSHY, Pramod (School of Materials Science and Engineering UNSW)

Co-authors: Mr CEN, Alan (School of Materials Science and Engineering UNSW Sydney); Dr YAO, Yin (Mark Wainwright Analytical Centre, UNSW Sydney); Dr WANG, Yuan (School of Chemistry UNSW Sydney); Dr CAZORLA, Claudio (School of Materials Science and Engineering UNSW Sydney); Dr MANOHAR, Madhura (Centre for Accelerator Science ANSTO); Dr ATANACIO, Armand (Centre for Accelerator Science ANSTO); Prof. SORRELL, Charles Christopher (School of Materials Science and Engineering UNSW Sydney)

Presenter: Dr KOSHY, Pramod (School of Materials Science and Engineering UNSW)

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