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Architectural and Structural Designs of Mo-CeO2-x Heterostructures To Achieve High Theoretical Capacitance

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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 CeO2-x, with ultrahigh surface area of 270 m2/g with volumetric oxygen vacancy was fabricated on nickel foam using chronoamperometric electrodeposition. The novel 2D CeO2-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 CeO2-x resulting in Mo-CeO2-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 CeO2-x, thereby revealing a new mechanism route for dual-valence metal oxides.

Speakers Gender

Male

Travel Funding

No

Level of Expertise

Experienced Researcher

Do yo wish to take part in the poster slam

No

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