Highly porous CeO₂ nanostructures prepared via combustion synthesis for supercapacitor applications

We report highly porous CeO₂ nanostructures (CeO₂ NSs) suitable for supercapacitor applications, synthesized using a fast and cost effective combustion approach. Due to its prominent valence states of Ce³⁺/Ce⁴⁺, CeO₂ has emerged as a promising pseudocapacitive material. The drawback of using CeO₂ as a supercapacitor electrode is its poor electrical conductivity. We overcame this drawback of CeO₂ by creating oxygen vacancies on its surface, which act to enhance its electrical conductivity. The physical interpretation of the as-synthesized CeO₂ NSs shows that they have dense active sites and diffusion pathways that enhance the performance of the electrode in a supercapacitor. Electrodes prepared using the synthesized CeO₂ NSs exhibited the initial specific capacitance of 134.6 F g⁻¹ and superior cycling stability of 92.5% after 1000 cycles at a constant current density of 1 A g⁻¹, indicating their potential suitability for use as efficient electrode for supercapacitor devices. The facile synthesis method used herein would help to reduce the cost and time required to synthesize CeO₂ particles and also would avoid the need to research and/or synthesize beneficial composite structures for enhancing the electrochemical properties of CeO₂ based electrodes.