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Small-Angle Neutron Scattering Analysis of a Novel Microemulsion-Based Electrolyte

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In this study, we introduce a novel class of aqueous electrolytes based on microemulsions that demonstrate an impressive high voltage window (2.2–2.5 V) and outstanding performance in supercapacitors. The electrochemical behavior is strongly influenced by the electrode morphology, specific surface area, and electrolyte composition. The extended voltage window is linked to the formation of a hydrophobic lamellar region aligned perpendicular to the electrode surface, followed by a bulk conductive microemulsion phase. Small-angle neutron scattering (SANS) analysis revealed a structural transition from normal ellipsoids to bicontinuous systems as the water-to-oil ratio in the bulk conductive phase increases. Additionally, the analysis showed that these phases remain stable across a wide temperature range, with only a slight reduction in domain size for the bicontinuous phase and droplet sizes of the ellipsoids. This innovative microemulsion-based aqueous electrolyte offers a promising pathway for designing high-voltage aqueous electrolytes, unlocking the safety and cost advantages of aqueous systems.

Topics

Neutron Instruments and Techniques

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