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Toward Safe and Sustainable Batteries: $Na_4Fe_3(PO_4)_2P_2O_7$ as a Low-Cost Cathode for Rechargeable Aqueous Na-Ion Batteries

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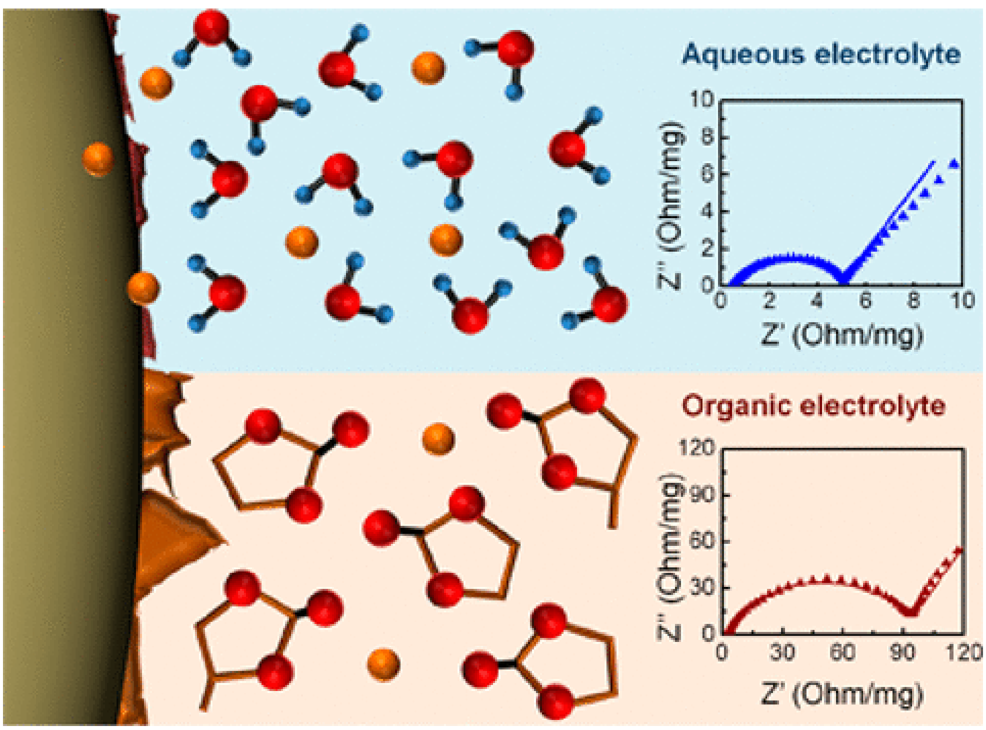
Abstract



The electrochemical properties of $Na_4Fe_3(PO_4)_2P_2O_7$ in aqueous and organic electrolyte are compared under similar conditions. $Na_4Fe_3(PO_4)_2P_2O_7$ is able to deliver almost the same capacity in both types of electrolytes despite the smaller electrochemical window entailed by the aqueous one. As shown by electrochemical impedance spectroscopy (EIS), this is possible thanks to the lower overpotential that this material exhibits in aqueous electrolyte. It is shown here that the main contribution to overpotential in organic electrolyte mainly originates from a SPI (Solid Permeable Interphase) layer formed below 3.5 V vs Na^+/Na that acts as a blocking layer and hinders Na^+ diffusion and that is absent in aqueous electrolyte. Overall, the obtained results highlight the positive attributes of using low-cost and environmentally friendly aqueous electrolytes and the challenges to be overcome in terms of air and moisture stability of the studied material.