Establishment of regularities of the influence of factors that determine the electrochemical stability window of aqueous electrolytes for sodium-ion batteries

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The use of water as a battery electrolyte provides better ion migration. Also, an aqueous electrolyte is more environmentally friendly and safe, the low price of such electrolytes is also important, in addition, water is an excellent solvent for many salts. The main problem of aqueous electrolytes is a narrow electrochemical stability window, beyond which water decomposition begins:

Anode side: $2H_2O \leftrightarrow O_2 + 4H^+ + 4e^-$ (1)

Cathode side: $2H_2O + 2e^- \leftrightarrow H_2 + 2OH^-$ (2)

In this work, we present a method for expanding of electrochemical stability window of aqueous electrolytes by coating the electrode with a hydrophobic layer. The resulting coatings were applied by soaking in solutions of various concentrations of paraffin in hexane and subsequent drying. The change in the stability window for coatings of various thicknesses, as well as the values of the electrode resistance and the thickness of the electrical double layer, were determined using electrochemical impedance. The effect on other electrochemical reactions was also investigated.

The resulting coating extended the stability window to 3.2 volts, compared to 2.9 volts in saturated sodium perchlorate. Coating to a greater extent window expanded in the anode region by 230 mV.

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