

Enhanced Resistance to Oxidative Decomposition of Aqueous Electrolytes for Aqueous Lithium-ion Batteries

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Accompanied with the rapid increase in the usage of sustainable energy, lithium-ion battery also has found spread use in large-scale energy facilities. Since sustainable energy such as solar- and wind-power generations has a problem related to the supply fluctuation, it is necessary to mitigate the fluctuation with some buffers, which store and release surplus electric energy. Despite a continuous improvement in the safety of lithium-ion battery, flammable organic solvents used in an electrolyte have fatal drawbacks, and therefore alternative electrolytes have been studied for large-scale energy storage applications. In addition to the safety issue, the cost for preparing ultra-dry organic solvents and handling these solvents in dry areas should be considered as a serious concern.

Among alternative electrolytes, aqueous electrolytes could meet the safety and cost requirements of an electrolyte for large-scale battery facilities, but their narrow electrochemical stability window (1.23 V) provokes another problem. Li et al. reported in 1994 the first concept of aqueous rechargeable lithium-ion batteries (ARLB) using LiMn_2O_4 and $\text{VO}_2(\text{B})$ as active materials [1]. They demonstrated the continuous charge-discharge performance, but the terminal voltage was limited (less than 1.5 V). It is obvious that the narrow electrochemical window diminishes the advantages of plentiful active materials for lithium-ion batteries. Many researchers have put considerable effort to overcome the limitation of electrochemical window, and a few effective ways have been found to stabilize aqueous electrolytes [2,3].

In this study, we demonstrate the enhanced resistance to oxidative decomposition of aqueous electrolytes by the addition of organosulfate [4]. The influence of organosulfates as an effective additive on the properties of aqueous electrolytes is investigated, and the mechanism of broadened potential windows of aqueous electrolytes is discussed.

References:

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