ENERGY STORAGE

Super pseudocapacitors

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Like batteries, supercapacitors can be efficient and sustainable energy storage systems. Conventional supercapacitors store charge through adsorption of ions from electrolytes on electrode surfaces. On the other hand, pseudocapacitors, or oxide supercapacitors, operate by a mechanism based on redox reactions at the electrodes, similar to that observed in batteries. Pseudocapacitors can offer higher energy densities than conventional supercapacitors, but they are still inferior to batteries. The key challenge is to achieve fast transport of both ions and electrons in oxides. Shi-Zhang Qiao and colleagues in Australia, China and the United States now report that an oxide material, $Zn_xCo_{1-x}O$, possesses both high ionic and electronic conductivity and a symmetric device assembled with the mixed oxide achieves a high energy density of 67.3 Wh kg^{-1}.

The mixed oxide, fabricated by a cation-exchange method used to integrate Zn ions into the CoO lattice, has several distinct and beneficial features. These include the uniformity of distributed Zn and Co ions, the predominant exposure of (111) facets of $Zn_xCo_{1-x}O$ nanoparticles, and the presence of a large number of O vacancies confined on the (111) facets. The integration of Zn ions substantially improves the poor electronic conductivity of CoO, and the uniform distribution of Zn and Co ions ensures the high electronic conductivity of the bulk $Zn_xCo_{1-x}O$. Additionally, the (111) facet offers low energy barriers for the mobility of O vacancies, facilitating rapid O-ion intercalation and subsequent oxidation of Co ions in the bulk $Zn_xCo_{1-x}O$ material.

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