

Nanowires for Electrochemical Energy Storage Applications

Abstract

Electrochemical reactions involve the exchange of electrons and ions at the interfaces between electrodes and an electrolyte allowing supercapacitors to store energy by separating positive and negative charges. Over the past few years, nanowires, as one of the representative one-dimensional (1D) nanomaterials, have demonstrated excellent capability for realizing a variety of applications in the fields of energy storage. Moreover, they offer 1D electronic pathways, which are key in charge transport, a large active interface between the electrolyte and electrode, etc. The high aspect ratio property of nanowires provides high surface area thereby enhancing electrolyte interaction with active electrode sites, resulting in increased material utilization, continuous electron transport, reduced resistance to charge flow, and improving electrode conductivity and kinetics. This chapter presents the theory, synthesis, and application of nanowires for electrochemical energy storage (EES) devices. It also highlights the scientific challenges associated with nanowires' integration into energy storage devices, including reduced coulombic efficiency, capacity decay, and poor cycling, with possible solutions. Finally, a projection into the future direction of nanowire's application in energy storage devices is presented and discussed.