High-power High-energy Li-ion full batteries using pseudocapacitive $Na_2Ti_3O_7$ nanotubes as advanced anode materials

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The presentation will highlight a new full battery configuration combining a pseudocapacitive sodium titanate ($Na_2Ti_3O_7$) anode with an intercalation-type $LiNi_{0.5}Mn_{1.5}O_4$ cathode. In specific, the kinetic Li^+ pseudocapacitance of anode is enabled by the ultrathin nanotube structure of the titanate, and the pseudocapacitance happens above 1 V (versus Li/Li^+), avoiding the safety issues of lithium plating and massive formation of solid electrolyte interface layer. The high-rate performance of $LiNi_{0.5}Mn_{1.5}O_4$ is attributed to the intrinsically high Li^+ mobility in the 3-D spinel crystal framework as well as the porous nanostructure. The two electrodes are highly compatible with each other, as a result, the full battery features battery-level energy density and capacitor-like power density, harvesting respectively 158 and 89 W h kg^{-1} when outputting power densities of 92 and 13000 W kg^{-1}.

Figure 1: Ragone plots compare our Li-ion full batteries with commonly available energy storage devices