Conducting polymer/TiO_2 nanotube arrays composites as an active material for high power energy storage devices

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There have been numerous studies of the electrode materials of electric double layer capacitors(EDLCs), such as activated carbons, carbon nanotubes, and other carbon based materials, which have a high specific surface area. Of the materials being developed for EDLCs, activated carbon remains the most promising, because of its low cost and high specific capacitance(~200F/g). However, the widespread commercial use of activated carbon is impaired by its low volumetric capacitance which results from its low density. In this study, the charge storage behavior of TiO2 nanotube arrays (Fig.1) from an electric double layer was investigated for the first time. The specific capacitance of the TiO2 nanotube arrays were greatly influenced not only by their crystalline structure, but also by the electrolyte composition. The volumetric capacitance of the TiO2 nanotube arrays was more than 2 times higher than that of activated carbon based EDLCs in a water based electrolyte. In addition, polypyrrole coated TiO2 nanotube arrays (Fig.2) were also prepared from the electrochemical deposition method and characterized their capacitive properties.