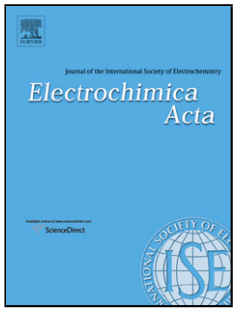

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Controlled synthesis and enhanced electrochemical performance of self-assembled rosette-type Ni-Al layered double hydroxide

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Abstract

We report the synthesis of a rosette-type three-dimensional Ni-Al layered double hydroxide (Ni-Al LDH) positive electrode material for energy storage devices using a template-free, simple, self-assembling hydrothermal synthesis method. Poly (sodium-p-styrene-sulfonate) (PSS) plays a key role in efficiently controlling the morphology. Moreover a model that explains the formation mechanism of rosette-type Ni-Al LDH is proposed. The model is verified by a series of experiments. SEM images reveal that the three-dimensional (3D) structure of Ni-Al LDH consists of individual nanosheets that form a rosette-type morphology thus improving its mechanical stability. The electrochemical properties of the material were studied by means of cyclic voltammetry (CV), galvanostatic charge/discharge measurements, and by electrochemical impedance spectroscopy (EIS). Owing to the greatly improved faradaic redox reaction and mass transfer, the 3D Ni-Al LDH structure exhibits excellent energy storage performance. This positive electrode material shows a high specific capacity of 788 C/g (the corresponding area-normalized capacity is 23.64 C/cm^2) at a charge/discharge current density of 1 A/g and retains 82.9% of its capacity after 1000 cycles at current densities of 2 A/g. These