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Fabrication of electrode materials for energy storage by electrochemical deposition

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Abstract:

In this presentation, the facile and low-cost electrodeposition techniques would be introduced for the fabrication of electrode materials in energy storage systems. Firstly, a pulse-reversal deposition mode was developed to directly fabricate Ni_3S_2 thin film on nickel foam as electrode for supercapacitors (SCs). The pulsed Ni_3S_2 electrode can deliver remarkable specific capacity up to 179.5 mAh g^{-1} and 105.9 mAhg^{-1} at charge–discharge current density at 2 A g^{-1} and 32 A g^{-1} in 1.0 M KOH aqueous electrolyte, respectively. Additionally, the optimal pulsed Ni_3S_2//carbon fiber cloth hybrid SC can be reversibly charged and discharged at a stable cell voltage of 1.8 V and generate an impressive specific capacity of 25.5 mAh g^{-1} at current density of 0.5 A g^{-1}, which can deliver a maximum energy density of 28.8Wh kg^{-1} at a power density of 684Wkg^{-1}. Secondly, NiS/Ni_3S_2 composite electrode can be synthesized by adjusting the PR parameters. The resultant NiS/Ni_3S_2 composite electrode presents an impressive specific capacity of 170.9 mAh g^{-1} at a current density of 2 A g^{-1} and a capacity retention rate of 65% at a current density of 10 A g^{-1} in 1 M KOH aqueous electrolyte. Furthermore, the hybrid SC based on NiS/Ni_3S_2 cathode and acidified activated carbon (AAC) anode exhibits the high specific capacity of 40.9 mAh g^{-1} at 2 A g^{-1} and an energy density of 38.1 Wh kg^{-1} at a power density of 1861 W kg^{-1} with a wide potential window between 0 and 1.8 V. Furthermore, the hybrid SC displays excellent cycling stability with only 3% performance loss after cycling of 1000 – 5000 consecutive charge/discharge tests at a relatively high current density of 4 A g^{-1}.