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Engineering of Stable and Improved Electrochemical Activities of Redox Dominating Charge Storage Electrode Materials

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Abstract : The controlled nanostructure growth and its strong coupling with the current collector are key factors to achieve good electrochemical performance of faradaic-dominant electroactive materials. We employed binder-less and additive-free hydrothermal and physical vapor doping methods for the synthesis of nickel (Ni) and cobalt (Co) based compounds nanostructures (NiO, NiCo2O4, NiCo2S4) deposited on different conductive substrates such as carbon nanotube (CNT) on stainless steel, and reduced graphene oxide (rGO) and N-doped rGO on nickel foam (NF). The size and density of Ni- and Co-based compound nanostructures are controlled through the strong coupling with carbon allotropes on stainless steel and NF substrates. This controlled nanostructure of Ni- and Co-based compounds with carbon allotropes leads to stable faradaic electrochemical reactions at the material/current collector interface and within the electrode, which is consequence of strong coupling of nanostructure with functionalized carbon surface as a buffer layer. Thus, it is believed that the results provide the synergistic approaches to stabilize electrode materials physically and chemically, and hence overall electrochemical activity of faradaic dominating battery-type electrode materials through buffer layer engineering.

Keywords : metal compounds, carbon allotropes, doping, electrochemicstry, hybrid supercapacitor
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