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Performance of Graphene Oxide Doped Polyaniline Composite Electrodes for Energy Storage: Effects of In-Situ Synthesis

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Abstract:
Two different synthesis processes, in-situ polymerization and ex-situ polymerization process, were implied to identify the impact of these processes on the properties of the graphene oxide (GO) doped conductive polyaniline (PANi)-based electrode materials. This study focused on the improvement of various properties of PANi/GO composite materials produced through the in-situ polymerization process instead of the ex-situ polymerization process. To compare the performance of electrochemical and physical properties PANi/GO electrode materials produced via in-situ and ex-situ polymerization process, several characterization techniques were used. Scanning electron microscopy (SEM), Fourier transform infrared spectroscopy (FTIR), and X-ray diffraction (XRD) were performed to observe structural properties. Cyclic voltammetry and galvanostatic Charge–Discharge analysis were conducted to investigate the electrochemical properties of electrodes. Specific capacitance of PANi/GO electrodes was found 63.6% higher for in-situ polymerization compared to the electrodes prepared using ex-situ polymerization process. This high performance was governed by the proper alignment of GO into polyaniline. In the in-situ polymerization process, the interaction of polyaniline is strong with the surface functional groups of GO sheets which results in a good physical mixture between polyaniline and GO particles. In-situ polymerization technique can be effective to develop polymer-based electrode materials for high performance supercapacitors.