Synthesis of Reduced Graphene Oxide/ Cobalt Oxide Composite as a Super Capacitor Electrode Material Using the Compounds Obtained by Recycling Lithium-Ion Batteries

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Today Lithium-ion batteries (LIBs) are widely used in many portable electronic devices, hybrid electric vehicles, and electric vehicles due to their unique features. However, the rapid increment in the disposal of used LIBs to the environment causes severe damages to the environment due to the presence of heavy metals. Thereby environmentally friendly recycling processes are important for LIBs in aspects such as recovering valuable metals from spent LIBs. In this work, a composite electrode material prepared using cobalt oxide (Co_3O_4) and reduced graphene oxide (rGO) synthesized respectively from cathode and anode material of spent LIBs is described. The battery type considered here was Sony Phone Battery (AGPBO16-A001). Cathode material was subjected to an acid leaching process using 2M H_2SO_4 along with 10% H_2O_2 followed by collective precipitation. The pink colour precipitate, obtained at pH 1.5 was confirmed as CoC_2O_4 using X-ray diffraction technique, Fourier-transform infrared spectroscopy, and X-ray fluorescence data. Subsequently, the annealed sample at 450 ^{0}C for 2 hours was undergone with the above tests and conformed as Co_3O_4 with a crystallite width of 17.7 nm. rGO was synthesized from the anode material using sonication assisted oxidation of graphite. rGO showed an interlayer spacing of 3.4 A^0 and a crystallite width of 7 A^0. Composites were prepared on a copper foil by varying the mass ratio of rGO and Co_3O_4. All the grown samples were examined for cyclic voltammetry measurements in the same photo electrochemical cell. The best electrochemical performance was shown by the composite with the mass ratio of rGO: Co_3O_4, 1:4. In future methods will be investigated to improve the capacitance of the composite electrode material.

Keywords: Lithium-ion Battery, Composite, Acid leaching, Capacitance