Controlling the Oxygen Vacancies in the Structure of Anode Materials for Improved Electrochemical Performance in Lithium-Ion Batteries

Authors : Moustafa M. S. Sanad

Abstract : The worsening of energy supply crisis and the exacerbation of climate change by environmental pollution problems have become the greatest threat to human life. One of the ways to confront these problems is to rely on renewable energy and its storage systems. Nowadays, huge attention has been directed to the development of lithium-ion batteries (LIBs) as efficient tools for storing the clean energy produced by green sources like solar and wind energies. Accordingly, the demand for powerful electrode materials with excellent electrochemical characteristics has been progressively increased to meet fast and continuous growth in the market of energy storage systems. Therefore, the electronic and electrical properties of conversion anode materials for rechargeable lithium-ion batteries (LIBs) can be enhanced by introducing lattice defects and oxygen vacancies in the crystal structure. In this regard, the intended presentation will demonstrate new insights and effective ways for enhancing the electrical conductivity and improving the electrochemical performance of different anode materials such as $MgFe_2O_4$, $CdFe_2O_4$, Fe_3O_4, $LiNbO_3$ and Nb_2O_5. The changes in the physicochemical and morphological properties have been deeply investigated via structural and spectroscopic analyses (e.g., XRD, FESEM, HRTEM, and XPS). Moreover, the enhancement in the electrochemical properties of these anode materials will be discussed through Galvanostatic Cycling (GC), Cyclic Voltammetry (CV) and Electrochemical Impedance Spectroscopy (EIS) techniques.

Keywords : structure modification, cationic substitution, non-stoichiometric synthesis, plasma treatment, lithium-ion batteries
Conference Title : ICEEP 2024 : International Conference on Electrochemistry and Electrochemical Processes
Conference Location : Paris, France
Conference Dates : September 16-17, 2024