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## ABSTRACT:

# Rietveld Refinement and Electrochemical Properties of Rare-Earth Cerium Substituted Nickel Ferrite for Fabrication of High Performance Electrodes of Supercapacitor Application

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The rare earth Cerium substituted nickel spinel ferrite having general formula NiCexFe2-xO4 at different composition (x = 0, 0.1, 0.2, 0.3, 0.4 and 0.5) electrodes has been synthesized through old ceramic route. The XRD micrographs reveals the single cubic spinel structure. The crystallite size decreases with the rare earth cerium concentration increases. The refinement parameters have been detected through X'pert high score plus software which shows the low value of R-factors that confirms the structural stability. The 3 D visual is simulated through the Vesta software to show the tetrahedral and octahedral sites. The SEM investigation indicated the existence of spherical grain particles, showing non-uniform cluster along with significant agglomeration. The grain size tends to decreases as the cerium content increases and this phenomena enhance the porosity which in results boosting the overall capacitance of synthesized rare earth substituted nickel cubic ferrites. The electrochemical properties of NiCexFe2-xO4 electrodes where x = 0, 0.1, 0.2, 0.3, 0.4 and 0.5 have been investigated through Cyclic Voltammetry, Galvanostatic charge-discharge and Electrochemical Impedence Spectroscopy techniques in a 6 M KOH electrolyte solution with different scan rates at potential window ranging from 0-0.5V. The specific capacitance of 1361.2 Fg−1 at 10mVs-1 has been attained. The electrode NiCe0.5Fe1.5O4 displays a retention of 91.2% for CV and 90.5% for GCD after 5000th cycles that reveals its stability in long-term electrochemical cycling. The influence of Cerium substitution on boosting the performance of the specific capacitance for supercapacitor can be concisely studied. Thus the NiCe0.5Fe1.5O4 electrode is highly suitable material for applications such as super-capacitor.