

# 4<sup>th</sup> International Conference on **Nanotek & Expo**

December 01-03, 2014 DoubleTree by Hilton Hotel San Francisco Airport, USA

## Structural and Vibrational Studies of Ni Al<sub>x</sub> Fe<sub>2-x</sub> O<sub>4</sub> Ferrites (0 ≤ x ≤ 1)

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Nickel–Aluminium ferrites milled at the nano-scale size with the general formula Ni Al<sub>x</sub> Fe<sub>2-x</sub> O<sub>4</sub> (0 ≤ x ≤ 1) were studied using X-ray diffraction, Infra Red and Raman spectroscopy. XRD diffraction patterns and their Reitveld refinements show that all samples have a pure single-phase cubic spinel structure. From these patterns, the lattice parameters of these samples have been calculated and compared with those predicted theoretically. Most of the values were found to decrease with increasing Al content. Infra Red spectra showed two significant absorption bands. The high band corresponds to tetrahedral (A) sites and the lower band to octahedral [B] sites, thus confirming the single phase spinel structure. For all compositions, Raman spectra show the five active modes A<sub>1g</sub> + E<sub>1g</sub> + 3 T<sub>2g</sub> of the motion of O<sup>2-</sup> ions and both the A-site and B-site ions. The Raman frequencies trend with aluminium concentration show a blue shift for all modes consistent with the replacement of Fe<sup>3+</sup> by lower mass Al<sup>3+</sup>. Composition dependence of the Raman frequency modes is discussed in relationship with the cations distribution among the A-sites and B-sites.

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