Title: Correlation among the structural, electric and magnetic properties of Al3+ substituted Ni–Zn–Co ferrites

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Abstract: This study explored the structural, electrical, and magnetic properties of diamagnetic aluminium (Al3+) substituted nickel-zinc-cobalt (Ni–Zn–Co) mixed spinel ferrites, though the research on this area is in the infancy stage. Single-phase cubic spinel structures with the Fd3m space group of the synthesized Ni0.4Zn0.35Co0.25Fe(2-x)AlxO4 (0≤ x ≤0.12) ferrite samples were confirmed by X-ray diffraction (XRD) analysis. The average particle size ranged from 0.67 to 0.39 mm. Selected area electron diffraction (SAED) patterns were indexed according to the space group Fd3m, representing the particle's crystallinity. The optical band gaps ranged from 4.784 eV to 4.766 eV. Frequency-dependent dielectric constants and ac conductivity measurement suggested that the prepared ferrites were highly resistive. Relaxation times were reduced to a low value from 45.45 ms to 1.54 ms with the composition x. The Curie temperatures (Tc) were 615–623 K for all samples. Real part permeabilities (m/ ) were relatively stable up to an extended frequency range of 106 Hz with relative quality factors (RQF) of around 103 . Tuning of the properties indicates that the fabricated ferrites may be promising for high-frequency electronic devices.