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A comparison study of some structural, vibrational, elastic and electron spin resonance properties of bulk- and nano-sized particles for $Zn_xCo_{1-x}Fe_{2-x}Al_xO_4$ ferrite samples

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A comparison study of nanosized $Zn_xCo_{1-x}Fe_{2-x}Al_xO_4$ ($x = 0, 0.2, 0.3, 0.4, 0.5, 0.7, \text{ and } 0.9$) and bulk counterparts obtained by annealing at 1000 °C for 3 hours is presented. X-ray diffraction (XRD), Fourier transform infrared spectroscopy (FTIR) and Raman spectroscopy studies confirmed the formation of cubic spinel structure for both the as-prepared and annealed samples. The as-prepared particle sizes range from (5 – 13 nm) while the annealed sample sizes range from (58 -62 nm). Annealing the nanoparticles at high temperatures reduces vacancies at lower concentrations ($x \leq 0.4$) of Zn and Al. On the FTIR data, the difference in absorption bands at $x > 0.4$ of the sample with nanoparticles decreases with an increase in dopants concentrations and they are lower than their bulk counterparts. The Raman mode associated with the vibration on the A-site is strongly affected by the site preference and the reduction of vacancies on this site. ESR and magnetization measurements reveal a reduction in magnetization with increasing particle size.

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YES

Level for award;(Hons, MSc, PhD, N/A)?

PhD

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