Sintering temperature dependent characterization of Ni nano ferrite with the optimization of frequency dependent properties

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Abstract

Ni ferrite is becoming a prominent candidate for high frequency applications. To find the best performance of Ni ferrite for high frequency devices, $NiFe_2O_4$ ferrites are synthesized by co-precipitation method at five distinct sintering temperatures (T_S =500℃, 700℃, 850℃, 1000℃, and 1200℃). The structural properties of the synthesized samples are characterized by x-ray diffraction (XRD) with Rietveld refinement analysis. The grain formation of the ferrites is observed by field emission scanning electron microscopy (FESEM) and the gradual increase in grain size is noticed with the increment of sintering temperature. The frequency dependent properties are studied by an impedance analyzer. The real permeability values of the samples are stable in a wide frequency range (100 Hz to 100 MHz) and the imaginary permeability values are decreased at lower frequency region. It can be seen that the real part of magnetic permeability increases significantly with sintering temperature. The real and imaginary dielectric properties are reduced at the initial applied field and become constant at higher frequencies. The magnetic quality factor and dielectric quality factor are enhanced with the increase of sintering temperature. Frequency dependent properties confirm that these ferrites are strong candidates for potential high frequency applications. Finally, it is found that, comparatively a higher sintering temperature is better for permeability properties, and a lower sintering temperature is better for dielectric properties.

Keywords: Ni ferrite, Sintering temperature, XRD, FESEM, Permeability