The effects of Cu\textsuperscript{2+} substitution and Zn\textsuperscript{2+} substitution on the nickel based and copper based spinel ferrites have been investigated. Six series of spinel ferrites with nominal compositions Ni\textsubscript{0.6}Cu\textsubscript{0.2}Zn\textsubscript{0.2}Fe\textsubscript{2}O\textsubscript{4}, Ni\textsubscript{0.4}Cu\textsubscript{0.4}Zn\textsubscript{0.2}Fe\textsubscript{2}O\textsubscript{4}, Ni\textsubscript{0.2}Cu\textsubscript{0.6}Zn\textsubscript{0.2}Fe\textsubscript{2}O\textsubscript{4}, and Ni\textsubscript{0.6}Cu\textsubscript{0.2}Zn\textsubscript{0.2}Fe\textsubscript{2}O\textsubscript{4}, Ni\textsubscript{0.4}Cu\textsubscript{0.2}Zn\textsubscript{0.4}Fe\textsubscript{2}O\textsubscript{4}, Ni\textsubscript{0.2}Cu\textsubscript{0.2}Zn\textsubscript{0.6}Fe\textsubscript{2}O\textsubscript{4}, were prepared by the sol-gel auto combustion technique. The samples were characterized by SEM, X-ray diffraction, TEM, FTIR, UV, dielectric properties and magnetic properties measurement. Grain size was measured from the scanning electron micrographs. The average grain size of sintered ferrites was within the range of 25 nm to 40 nm and 124 nm to 219 nm for Ni\textsubscript{0.8-x}Cu\textsubscript{x}Zn\textsubscript{0.2}Fe\textsubscript{2}O\textsubscript{4} and Ni\textsubscript{0.8-x}Cu\textsubscript{0.2}Zn\textsubscript{x}Fe\textsubscript{2}O\textsubscript{4} ferrites respectively. The x-ray diffraction was done through Philips x-ray diffractometer using CuKr radiations (\(\lambda = 1.5405 \text{ Å}\)). Lattice constant and sintered density increased with increase in copper concentration in case of Ni\textsubscript{0.8-x}Cu\textsubscript{x}Zn\textsubscript{0.2}Fe\textsubscript{2}O\textsubscript{4} (x=0,0.2,0.4,0.6) ferrite, whereas it increase with increase in zinc concentration in case of Ni\textsubscript{0.8-x}Cu\textsubscript{0.2}Zn\textsubscript{x}Fe\textsubscript{2}O\textsubscript{4} ferrites. X-ray density and porosity decreases in both prepared ferrites as copper and zinc concentration increases respectively.

TEM images with SAED patterns indicates that particles are aggregated during annealing and metal ion incorporation, and concludes that the nanoparticles are organized into an isooriented attached structure by sharing identical lattice planes. The FTIR spectroscopy confirms the single phase nature of the prepared sample.

The dielectric constant was measured as a function of Cu substitution in Ni\textsubscript{0.8-x}Cu\textsubscript{x}Zn\textsubscript{0.2}Fe\textsubscript{2}O\textsubscript{4} ferrites as well as a function of Zn concentration in Ni\textsubscript{0.8}Cu\textsubscript{0.2}Zn\textsubscript{x}Fe\textsubscript{2}O\textsubscript{4} ferrites. The dielectric constant and dielectric loss factors were measured as a function of frequency for all the samples in the range of 100 Hz to 1 MHz at room temperature and 700\textdegree C.

To measure the magnetic properties of the prepared materials, the M-H loop of the specimen were drawn using VSM. From the M-H loop of the sintered material; we measured saturating magnetization, magnetic moment, coercivity.

The UV-Vis measurement suggests that the as-prepared and sintered samples at 700\textdegree C of Ni\textsubscript{0.8-x}Cu\textsubscript{x}Zn\textsubscript{0.2}Fe\textsubscript{2}O\textsubscript{4} ferrite posses different optical properties depending upon the composition of the samples.