Abstract

The aim of this thesis to study some physical properties for the Ba-Mn ferrite doped with Zn ions, prepared using the usual ceramic method. The structure, electrical, optical, and magnetic properties were investigated using X-ray diffraction, Fourier transform infrared spectroscopy, ultraviolet-visible spectroscopy, and low-frequency capacitance measurements. The analysis of X-ray diffraction patterns showed that they were single phase and had the hexagonal structure. The average grain size, lattice constant, and bulk density were found to increase whereas the x-ray densities porosity decreased as Mn^{2+} ion substitution increased. FTIR spectra supported the XRD findings, exhibiting characteristic peaks at 434and 599 cm^{-1}, indicative of M-type hexagonal ferrite formation. The effect of temperature, frequency and composition on the ac electrical conductivity and dielectric behavior were studied in the frequency range from 170 Hz to 100 KHz and temperature from 300 K to 600 K. The experimental results indicated that the ac electrical conductivity, real dielectric constant, and dielectric loss increase with increasing temperature, which signifies the semiconductor behavior. The ac electrical conductivity increases while the dielectric loss, real dielectric constant decrease as frequency increases. The real dielectric constant has abnormally behavior and exhibits a dielectric relaxation process or peaks at relatively higher temperatures. The relaxation frequency shifts to higher frequency as the temperature increases and decrease as Zn ion substitution increases. The A.C electrical conductivity, real and imaginary dielectric constant, and dielectric loss were found to be composition dependent. The optical energy gap of the synthesis ferrite samples increases with increasing Mn content from 2.80–3.08 eV, which confirms that the synthesized material shows semiconducting behavior. The optical constants; refractive index extinction

coefficient and dielectric constant decrease with the increase in the doping percentage.

The initial permeability increases with increases zinc concentration and decrease with increase sintering temperature. Curie temperature decrease as the Zn ion substitution increases, due to replacement of magnetic ions Mn^{2+} with non-magnetic ions Zn^{2+}.