AC Conductivity and Dielectric Response of Cd^{2+}, Cr^{3+} and Al^{3+} Substituted Spinel Ferrite Systems

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We have attempted to analyze room temperature dielectric behaviour of the following spinel ferrite systems in the frequency range: 100 Hz to 2 MHz.

(1) $Ni_{1-x}\ Cd_x\ Cr_xFe_{2-x}O_4$: (NCC),
(2) $Li_{0.5}Al_xCr_xFe_{2.5-2x}O_4$:(LAC) ,
(3) $CuAl_xCr_xFe_{2-2x}O_4$: (CAC)

The shape of ε' (f) curves for all the three systems is similar. The variation reveals the dispersion due to Maxwell-Wegner type interfacial polarization which is in agreement with Koops phenomenological theory. The exchange of electrons for CAC and LAC(x=0.4-0.8) system (n-type) and holes for NCC and LAC(x=0.0, 0.2) systems (p-type) may lead to local displacement of charge carriers in the direction or opposite direction of the applied field, these determine the polarization. In each case the AC conductivity increases with increase in the frequency from 100Hz to 2 MHz, which is the normal behaviour of ferrites. The conduction mechanism in ferrites can be explained on the basis of hopping of charge carriers on the adjacent octahedral sites. It is clear that for the LAC and CAC systems the dissipation loss factor shows continuously decreasing trend with rise in frequency whereas the NCC system exhibits a loss peak for all the three compositions at different frequencies. It is observed that the position of the dielectric loss maxima shifts towards the lower frequency with increasing Cd-Cr content(x) in NCC system. It can also be inferred that the relaxation time increases with increasing content (x).