substance: NiO
property: dielectric relaxation in Li doped NiO

At low temperatures and low frequencies, the change $\Delta\varepsilon$ in dielectric constant on doping with Li has the form $\Delta\varepsilon = 4\pi N p^2/1.5kT$ (CGS units), where N is the concentration of Li^+ – Ni^{3+} dipoles and p the associated dipole moment. At higher frequencies dispersion and deviations from the formula appear. Very similar dielectric loss peaks are found for Na doped NiO [70B] (Fig. 1). Relaxation processes due to Ni^{3+} holes hopping around Li^+ have been identified [68A]. These appear to behave as small polarons with a hopping energy of 0.20...0.25 eV.

Corresponding data on Na doped NiO showed significantly higher resistivities (by some four orders of magnitude) and activation energies than the corresponding Li doped samples. The thermoelectric power of the Na doped samples is also much higher [81D].

References:

68A Austin, I. G., Clay, B. D., Turner, C. E.: J. Phys. Cl (1968) 1418.

70B Bosman, A. J., van Daal, H. J.: Adv. Phys. 19 (1970)1.

81D Dutt, M. B., Banerjee, R., Barua, A. K.: Phys. Status Solidi (a) 65 (1981) 365.

Fig. 1.

NiO:Na. (a) Real part of the dielectric constant vs. temperature for different frequencies for a sample doped with 0.1 at% Na. The broken line represents the behaviour of $\varepsilon(0)$ if $\Delta\varepsilon$ (for definition, see the tables) is proportional to T^{-1}, (b) imaginary part of the dielectric constant vs. frequency for different temperatures measured on the same crystal as in (a). The broken line represents a Debye curve with its maximum at 10^7 Hz [70B].