Physics Hons.

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Dr. Sanjeet Kumar
Assistant Professor
Deptt. of Physics,
H.D. Jain College,
VKSU, Ara,
Bihar - 802301.
India.

Electronic, Ionic and Dipolar Polarizabilities

When a dielectric is placed in an electric field, its molecules may be affected in three ways. There is a displacement of the electron-cloud relative to the nucleus in the atoms constituting the ~~molecules.~~ molecules. Thus dipole moment is induced in molecules. This is 'electronic' polarisability.

Secondly, if we have a solid whose molecules are made up of ions, there is a relative motion of positive and negative ions resulting in induced dipole moment. This is 'ionic' polarisability. Finally, if there are molecules with permanent dipole moments, randomly oriented, they tend to align in the direction of the applied field thus producing a net dipole moment. This is 'dipolar' or 'orientational' polarisability.

Thus, dielectric polarisation may be considered as a sum of three contributions:

$$P = P_e + P_i + P_o,$$

where the subscripts e, i and o stand for electronic ionic and orientational polarisation respectively. Correspondingly,

$$\alpha = \alpha_e + \alpha_i + \alpha_o$$

the 'deformation' polarisability resulting from the deformation of molecules caused by the electric field, and α_o is the 'orientational' polarisability. Non-polar molecules can show only deformation (electronic and ionic) polarisability while polar molecules can show both deformation as well as orientational polarisabilities.

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