

POLYMER SCIENCE DICTIONARY

MARK S.M. ALGER

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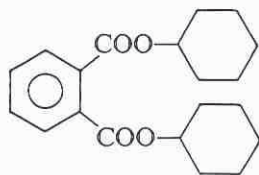
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An alicyclic diisocyanate useful in the formation of polyurethanes by reaction with a polyol, with superior resistance to yellowing on thermal or photo-oxidation. Synthesised by reduction of 4,4'-methylene-bisaniline, itself a product of reaction of formaldehyde with aniline, then reaction with phosgene.

DICYCLOHEXYL PHTHALATE (DCHP)



B.p. 220–228°C/760 mm. M.p. 69°C.

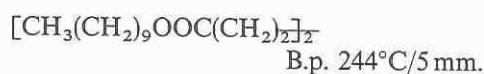
A plasticiser for polyvinyl chloride and its copolymers, polystyrene, ethyl cellulose and cellulose nitrate, of low water solubility.

DICYCLOPENTADIENE Alternative name for bicyclopentadiene.

DICYCLOPENTADIENE RESIN A petroleum resin consisting of the low molecular weight polymer obtained by thermal polymerisation of fractions from petroleum cracking containing large amounts of dicyclopentadiene, but also some styrene and indene. The polymers are useful as plasticisers but can have high softening points (up to 175°C) when of higher molecular weight.

DIDA Abbreviation for diisodecyl phthalate.

DI-*n*-DECYL ADIPATE (DDA)



A plasticiser for polyvinyl chloride and its copolymers for good low temperature flexibility and permanence.

DIDECYL PHTHALATE (DDP) Alternative name for diisodecyl phthalate.

DIDP Abbreviation for diisodecyl phthalate.

DIELECTRIC An alternative name for an electrically insulating material, which may be considered to be one with a resistivity of greater than about $10^{10} \Omega \text{ cm}$. Most polymers, excepting those that are specially produced as conductive or semiconducting polymers, are thus dielectrics. From an electronic point of view, a dielectric has a filled valence band separated widely from the higher energy valence band, so that application of an electric field cannot elevate other than a few electrons to this level. However, application of an electric field causes polarisation and in alternating fields dielectric dispersion and dielectric loss will occur.

DIELECTRIC BREAKDOWN The permanent loss of the insulating properties of a dielectric material due to the

application of an excessive electric field. At the high voltages involved, breakdown is usually sudden and catastrophic, with the material often becoming burnt out between the electrodes. The resistance to breakdown is measured as the dielectric strength. Although a dielectric has an intrinsic dielectric strength, under most conditions met with in practice breakdown occurs at much lower voltages. This may be due to thermal breakdown, breakdown by discharges, by tracking or by electrochemical breakdown.

DIELECTRIC CONSTANT Alternative name for relative permittivity.

DIELECTRIC DISPERSION The variation in the dielectric properties of a dielectric (particularly the relative permittivity and loss) with frequency or temperature. It is particularly marked in the region of a dielectric relaxation. The term sometimes refers in particular to the difference between the low frequency and the high frequency values of the relative permittivity (on either side of a relaxation), although this is more usually called the relaxation strength.

DIELECTRIC LOSS FACTOR (Loss factor) (Loss index) Symbol ϵ'' . The imaginary part of the complex relative permittivity. It is equal to the product of the relative permittivity (ϵ') and the dielectric loss tangent, i.e. it is $\tan \delta$. ϵ'' is frequency dependent, the dependency being given by one of the Debye equations. In the region of a dielectric relaxation, ϵ'' passes through a maximum value. Determination of the frequency at which the maximum occurs (ω_{max}) is an important way of characterising polymer relaxation (by dielectric spectroscopy) and in determining the relaxation time (τ), since $\omega_{\text{max}} = 1/\tau$. ϵ'' may be determined, in the appropriate different frequency ranges, by the DC step-response, ultralow frequency or audio frequency, e.g. Schering bridge, resonant current or wave transmission methods. Values for ϵ'' for polymers vary from about 0.0001 for non-polar polymers to about 1.0 for polar polymers in the region of a transition.

DIELECTRIC LOSS TANGENT (Loss tangent) (Dissipation factor) Symbol $\tan \delta$. The tangent of the loss angle when a dielectric is subject to a sinusoidally varying applied electric field. Since $\tan \delta$ equals ϵ''/ϵ' , i.e. the ratio of the imaginary (loss) to the real (storage) relative permittivities, it is also the ratio of the energy dissipated to the energy stored for each cycle. It is the most commonly used parameter for expressing the 'lossiness' of a dielectric, when it is sometimes referred to as the power factor ($\sin \delta$). However, any confusion is, in practice, minimal, since for low loss dielectrics, e.g. with $\tan \delta < 0.1$, the difference is $< 0.5\%$. Usually $\tan \delta$ is determined experimentally at the same time as the relative permittivity using any of the methods available for the latter. $\tan \delta$ is highly frequency and temperature dependent, reaching a maximum value as a dielectric relaxation is passed. Values for non-polar polymers can be as low as