

THE EFFECT OF DEFORMATION OF PLASTICIZED POLYVINYL CHLORIDE ON MOLECULAR MOBILITY*

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(Received 3 February 1987)

It was shown that uniaxial deformation of polyvinyl chloride, plasticized with dibutyl phthalate retards the molecular mobility of the plasticizer, displacing the correlation time spectrum towards higher values and distorting its shape. Appreciable anisotropy of the motion of dibutyl phthalate molecules is not observed. The behaviour of the parameters of nuclear relaxation of the polymer under strain is explained by the assumption of the existence of a 3-dimensional network in plasticized PVC.

THE NMR method gives useful information on the structure and properties of the PVC-plasticizer system from which the compatibility of plasticizers with the polymer, their efficiency and type of molecular motion can be judged [1]. However, in spite of intensive studies in this area, the effect of deformation of plasticized PVC on the parameters of the plasticizers' molecular mobility has been little studied [2].

The object of the present work was therefore to study the molecular mobility of dibutyl phthalate (DBT) under conditions of uniaxial stretching deformation of DBT-plasticized PVC at different temperatures.

C-70 grade PVC, plasticized with DBT (chem. pure) was used. The concentration by weight, ω_1 of the DBT in the samples was 18.36 and 58% (samples 1, 2 and 3 respectively). The samples were prepared by milling on laboratory rolls at $160 \pm 5^\circ$ (sample 1), $150 \pm 5^\circ$ (sample 2) and $140 \pm 5^\circ$ (sample 3). The other preparative conditions and heat stabilizing additives are the same as given in [3]. Strips of material, size $40 \times 5 \times 0.5$ mm laid in a batch, were fixed in a stretching appliance, then placed in an NMR cell in which the extension took place. The maximum extension was $\lambda = l/l_0 = 3$, where l and l_0 are the strained and unstrained lengths, respectively. The precision of strain recording was 5%. Before the initial measurements, the sample was maintained at 100° for 2 hr [4]. Each new strain value was held at 80° , followed by a 2 hr holding time before a new measurement.

The time for nuclear magnetic transverse relaxation T_2 was measured on an NMR impulse relaxometer with 31 MHz resonance frequency [5]. T_2 was determined either from the drop in free induction (DFI) for T_2 values 500 μ sec, or by the Kapp-Purcell-Mayboom-Hill method for T_2 500 μ sec with intervals between the π -impulses of 200 μ sec at 20, 40, 60 and 80° .

The DTI and the deflecting spin echoes $A(t)$ are complex and in the above temperature range, in general, may be approximated by summing the curves of:

$$A(t) = A_{0a} \exp\left(-\frac{t}{T_{2a}}\right) + A_{0b} \exp\left(-\frac{t}{T_{2b}}\right) + A_{0c} f(t), \quad (1)$$

where T_{2a} is the longest transverse relaxation time, T_{2b} is an intermediate one and $f(t)$ is a decreasing

* Vysokomol. soyed. A29: No. 7, 1437-1441, 1987.