investigation, so that annihilation and other recombination reactions occur and specifically low energy boundaries would be expected. This restriction seems not incisive in the present case for the following reason: Holt treated the rearrangement of a statistical distribution of dislocations into a modulated distribution assuming the total number of dislocations to be constant with respect to time. In fact this condition is fulfilled for LiF even in the steady state of deformation [3], which is characterised by a dynamic equilibrium between work hardening processes and recovery processes. Thus the rate of dislocation generation is balanced by the rate of dislocation annihilation. Therefore we feel that steady state values of ρ_0 and d are particularly suitable to verify equation 1.

Conclusion

Holt's model gives an excellent contribution to the basic understanding of cell formation. The good agreement between experimental data and Holt's equation 1 shows that this formula describes very well the modulated dislocation configuration observed in LiF at high temperatures during steady state deformation.

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Nematic to Smectic Transition in Linear Polyethylene

Lupolen 6001 H (BASF, Germany) was stretched ten-fold at 80°C from a neck which in a special oven had a length of only 2 mm. Both density ρ and the long periodicity P increase in a well-known manner by annealing at temperatures higher than 110°C in a first period of some minutes. Then suddenly ρ stays constant over a second period of some minutes while P solely increases [1]. From a careful two-dimensional analysis of small angle X-ray scattering by means of the theory of paracrystals, one can prove that during the second period the nematic-like superstructure with chains, regularly folded at the crystalline amorphous interfaces, turns into a smectic-like superstructure with quite irregularly folded chains. The interface now is rough in the chain direction with a continuous transition zone, between crystalline and amorphous regions, of about 30 Å length. The NMR spectrum in the first period shows an increasing second moment $\langle H_\alpha^2 \rangle$ of the crystalline component [2]. During the second period the second moment suddenly decreases. This, in connection with the constant ρ, proves that during the second period the chains in the crystalline domain regain a higher mobility without enlarging the volume of the "crystalline phase". As a consequence of this the observed change of the structure of the interfaces can take place. At the end of the second period ρ together with P begins to increase again with annealing time. Now many crystalline parts of adjacent ultra-fibrils are aligned parallel to each other, building up thicker ultrafibrils with diameters of about 200, 300, 400 Å and more.

The folding positions of the molecules within these domains also align increasingly during the next minutes. Then the interfaces again become as smooth as at the end of the first period.

From the above mentioned two-dimensional small angle analysis it can be proved that the

second meridional interference, which after the second period becomes increasingly distinct, is not produced by interferences between micro-paracrystallites, but is the first subsidiary maximum of their Fourier-transform (shape- or particle-factor). Herefrom it can be concluded that in the one carefully studied case the amorphous region has a thickness of about 10 Å, and the crystallites a length of about 260 Å in the fibre direction. However, using the conventional densities of both phases, the calculated density is much too high. From this it must be concluded that there are lateral interfaces of lower density between adjacent microparacrystallites similar to the grain boundaries observed in PE single crystals. For these reasons the "two-phase-model" is only a first rough approximation.

Acknowledgement

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The Mechanical Properties of Carbon Fibres Coated with Titanium Carbide

The mechanical properties of carbon fibres are degraded by nickel or cobalt coatings following thermal treatment [1] and by silicon deposition [2]. A possible way of protecting the fibres from such an attack is to sheath them in a non-reacting material. Carbides are possible candidates for this role provided that they do not themselves affect the fibres during the deposition process.

We have studied Courtaulds "Grafil HT" fibres, thinly coated with titanium carbide by chemical vapour-deposition (CVD) from a mixture of hydrogen, methane and titanium tetrachloride vapour at high temperature [3].

The mechanical properties are compared in fig. 1 with the curves obtained previously for uncoated fibres using the same experimental technique [4]. In accord with the established diameter dependence of the properties of type "HT" fibres [5], diameter is used as abscissa.

Although there is scatter in the data, typical of carbon fibres, it is apparent that Young's Modulus of the coated fibres is not significantly different from that of the uncoated fibres shown by the continuous line in fig. 1. The thin coatings applied here (about 0.1 μm thick or amounting

to some 4 vol % on a 8 μm diameter fibre) could increase the modulus of the fibres. Using the law of mixtures, the upper limit of this effect may be estimated as about 3 % or within the scatter band of results. An exact estimate of the upper limit cannot be given, partly because data for the variation of modulus of elasticity of TiC with carbon content are not available. In the above calculation a modulus of 4.8×10^4 kg/mm^2 was used for TiC, the average for TiC$_{0.95}$ [6] and TiC$_{0.91}$ [7], however, the composition of the carbide coating was deduced as about TiC$_{0.6}$ (measured by X-ray diffraction and using the reported variation of lattice parameter with carbon content [8]). Contrary to the trend shown by the modulus, the fracture strength and strain both appear to be somewhat reduced by the presence of the carbide coating. The reduced fracture strength of the coated fibres is believed to be related to the cracking of the coating – at a sufficiently high load the shock induced by the cracking might lead to catastrophic failure of the fibres. On some load-extension curves, "kinks" – small load drops – were noted, and were shown to be associated with local cracking in the carbide coating (fig. 2a). Not all specimens showed this effect, whilst some samples which "kinked" at a low strain showed a second "kink" at higher strain.