

12-Amorphous, Imperfectly Ordered and Quasi-periodic Materials

351

opened disk D^2 and the circle S^1 . The structure group $SO_0(1,2)_\times$ $SO(2)$ is a direct product of pseudoorthogonal group $SO_0(1,2)$ and orthogonal one $SO(2) \approx S^1$. The topological classes of random configurations result from the classification of the bundle P and we have shown that they are in one to one correspondence with two integer numbers $\{m_1, m_2\}$. Hence there are an infinite number of topologically stable equivalence classes of random configurations in this case. This is an exact result.

References

1. Manzhar V. V., *Krystallographiya*. 1990, 35, p. 1367.
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12.03 - Glasses and Polymers

DS-12.03.01

FIBER DIFFRACTION OF POLYMERS-RECENT RESULTS ON POLYSACCHARIDES.

By P. Zugenmaier Institute for Physical Chemistry, TU Clausthal, D-3392 Clausthal-Zellerfeld, Germany.

Polymer fibers exhibit poor X-ray patterns which are not suitable for a full structural evaluation as for example the data obtained from a single crystal analysis.

A method will be described which allows with the use of potential energy calculations, additional data of various sources and X-ray intensities from X-ray fiber pattern, a structure determination with regard to conformation and packing of polymers. Results on polysaccharide structures as derivatives of amylose and cellulose and solvent inclusion complexes will be discussed.

DS-12.03.02 STRUCTURAL DISORDER OF POLY(VINYLDIENE FLUORIDE). By Yasuhiro Takahashi, Department of Macromolecular Science, Faculty of Science, Osaka University, Toyonaka, Osaka 560, Japan.

Poly(vinylidene fluoride) (PVDF) possesses several polymorphs. In the present paper, the crystal structures and structural disorders of PVDF are described.

Form I The molecule assumes the slightly deflected planar zigzag conformation. Two chains are contained in the unit cell with parameters, $a = 8.58 \text{ \AA}$, $b = 4.91 \text{ \AA}$, $c = 2.56 \text{ \AA}$ and the space group $Cm2m$. The crystal structure assumes the statistical structure in which two chains related by the mirror symmetry occupy a crystal site with equal probability. A diffuse streak scattering is observed on the line binding 110 and 001 reflections. This streak is interpreted by the kink band of $GT\bar{G}$ conformation parallel to the (111) plane in the crystallite of the planar zigzag molecule (T: trans, G: gauche, \bar{G} : minus gauche). The rather regular arrangement of $GT\bar{G}$ in TT conformation is found in the incommensurate form which is observed as extra spots on the fiber diagram of polar II. On the equator and the first layer line, the diffuse streak scatter-

ings are observed on the lines binding 110 and $\bar{1}10$, 020 and 220, 110 and 200, 111 and 201 reflections. These streaks are attributed to two kinds of glides (alip planes) parallel to the planes (100) and (110).

Form II Two chains with $TGT\bar{G}$ conformation are contained in the rectangular unit cell with parameters, $a = 4.96 \text{ \AA}$, $b = 9.64 \text{ \AA}$, $c = 4.62 \text{ \AA}$ and the space group, $P2_1/c$. In the crystal, four molecules with different orientations statistically occupy a crystal site with different probabilities. This statistical structure is caused by two kinds of anti-phase domain structures: one is the domain concerning the direction of the molecule on the c-projection and the other is the domain concerning the pointing direction, up and down of the molecule.

Streak II This is the intermediate form between forms II and III and transforms to form III by heat-treatment. In form III, the molecule assumes $T_3GT_3\bar{G}$ conformation. On the fiber diagram of streak II, diffuse streak scatterings are observed from the reflections of form II along ζ -direction. These are attributed to the kink bands of TT conformation parallel to the (001) in the crystallite of $TGT\bar{G}$ conformation. Streaks are going to the sharp spots of form III during heat-treatment. This shows that the molecular conformation gradually changes from form II of $TGT\bar{G}$ to form III of $T_3GT_3\bar{G}$ during the heat-treatment.

DS-12.03.03 TIME RESOLVED X-RAY DIFFRACTION OF ORGANIC POLYMERS AROUND THE GLASS TRANSITION. By A. Mahendrasingam, W. Fuller*, A. Turner, *D.J. Blundell, *D. MacKerron, **R.J. Oldman, Department of Physics, Keele University, England, *ICI plc, Wilton, England and **ICI plc, Runcorn, England.

A comparative study of structural transitions in the organic polymers poly(aryl-ether-ether-ketone) (PEEK) and polyethylene terephthalate (PET) in response to mechanical stress and temperature around the glass transition has been made using the UK SERC Daresbury Laboratory X-ray Synchrotron Radiation Source with a FAST TV detector. The studies of PEEK are of particular interest. Close to the glass transition ($\sim 152^\circ\text{C}$) annealing (without further drawing) of originally cold drawn specimens show a dramatic loss of orientation in the high angle fibre diffraction pattern which after ~ 10 seconds is regained and followed by crystallisation. Complementary time-resolved small angle x-ray fibre diffraction studies have allowed changes in the gross organisation of polymer chains to be correlated with the changes in polymer conformation and packing indicated by changes in the high angle diffraction.