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The Mechanical Properties of Anisotropic Polymers

Progress Report No. 5



A report of work carried out during the period
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PART 1

General Developments

A general survey of the work carried out in the period October, 1965, to September, 1967, was given in Progress Report No. 4 (September, 1967). Apart from apparatus studies, the main experimental results described in Report No. 4 were concerned with the tensile creep of highly oriented, low-density polyethylene. Despite the fact that the measurements were incomplete, several trends were apparent in the results and details of proposed methods of analysis were given. Of great interest were the preliminary results on the simultaneous measurement of longitudinal extension and thickness contraction during tensile creep. These not only enabled a complete description of the pseudo-elastic constants of the material to be given, but also gave support to a deformation hypothesis by showing that a sample cut at 45° to the draw direction underwent negligible thickness contraction during tensile creep.

In view of the extreme usefulness of the combined extension and contraction measurements mentioned above, an attempt was made to improve the methods of measurement before completing the polythene study. Details of these apparatus developments are given in part II.2 of this report.

On completion of the required apparatus, the polyethylene study was continued; greater emphasis than before being placed on the combined measurement of extension and contraction. The new results are described in part III. These results complete this phase of the study on polyethylene. A summary of the investigation has been written, with the intention of submitting it as a letter to Nature. It is at present being examined at the Ministry of Technology. A detailed report is also being prepared at present.

In preparation for creep studies on rigid thermoplastics, preliminary trials of a 'heavy-duty' creep rig were carried out in the previous period. (See Report No. 4, page 5). A slightly modified version of one of the creep rupture rigs, described in Progress Report No. 3 (March, 1967), was used, but was found to be unsatisfactory. Improvements have now been made to the apparatus and satisfactory test results obtained. These are described in part II.3 of this report. A simple two-transducer extensometer for use with the heavy-duty creep rig is described in part II.4.

Preliminary trials of a shear rig have also been made, but will not be described in this report. (See part II.1).

