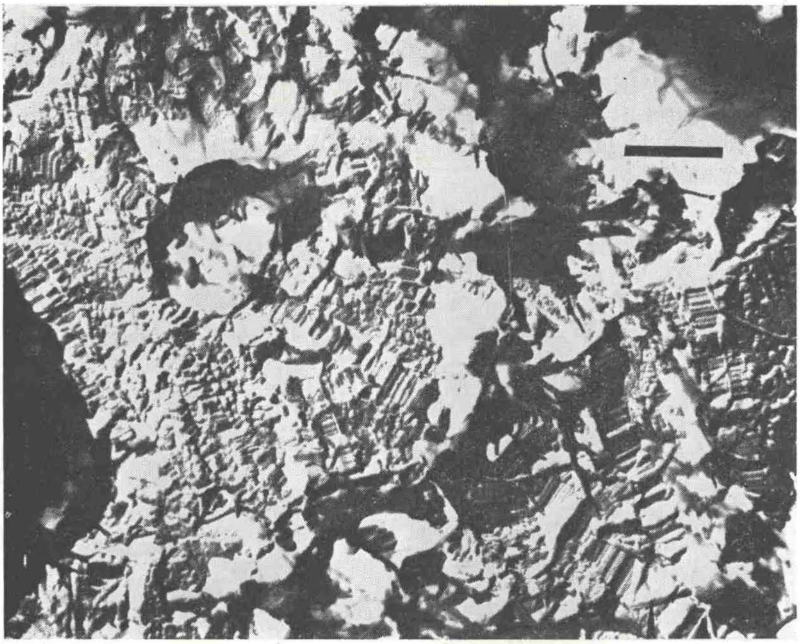

Fig. 2. Fracture surface of sample D. The dark areas in this and the other micrographs are a result of polyethylene adhering to the replica.

were intermixed, as in Figure 2 a significant number of regions were observed in which all the lamellae were of the same thickness, this being on the order of 300–400 A. The relative length of the striations, with respect to their separation, in the type III lamellae causes the thicker lamellae to have a different appearance than the thinner ones. However, there appears to be no basic difference in their structure. Structures similar in appearance to the thinner lamellae have been observed in moderately crystalline polytetrafluoroethylene (~50–70%).[7,16,17] In that case, however, all of the bands present were of about the same thickness and considerably smaller in lateral extent than in the case of the more highly crystalline polymer. In sample D the thick and thin lamellae appear to have equivalent lateral dimensions.

The general appearance of the fractured type III lamellae in sample C (Fig. 1) differs from that of the lamellae of corresponding thickness in sample D (Fig. 2); the fracture surface of each lamella and the whole surface appears smoother. Whether this is characteristic of the thermal treatment of the two samples during crystallization or a result of possible differences in the fracturing and replicating process is not known. One notes that the striations in Figure 1 (sample C) in many cases make an angle of other than 90° with the lamellae (this occurred only infrequently in sample D) and also appear more closely spaced than those in Figure 2.

The entire fracture surface of samples E and F and thus probably the whole sample is occupied by extended chain lamellae of various thicknesses

(Fig. 3). Samples E and F appear nearly identical, E perhaps having a few lamellae somewhat thicker than F. In both samples optical microscope observations of the replicas and also of the fracture surfaces themselves, indicates that the lamellae are organized in incipient spherulites, i.e., sheaf-like clusters are found. The center of such a sheaf is located at the lower left of Figure 3.

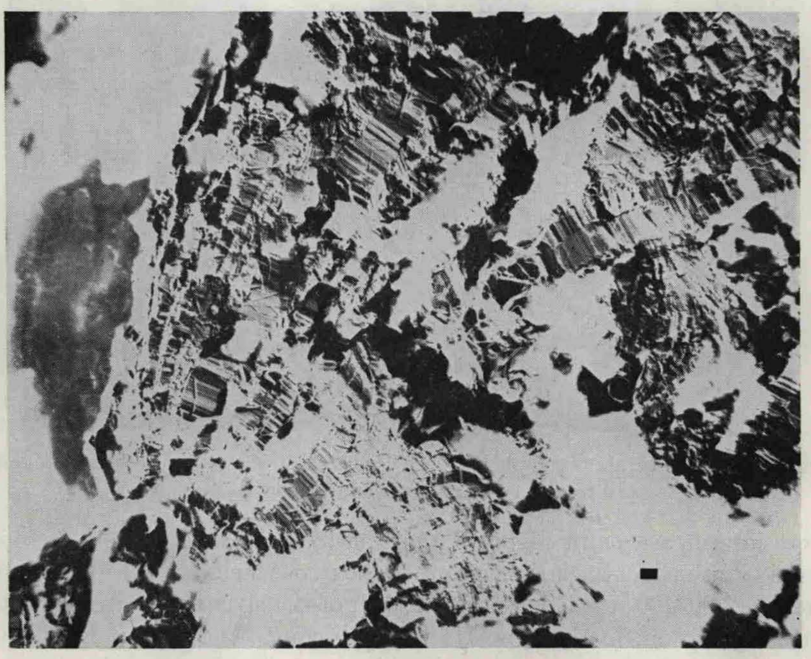

Fig. 3. Fracture surface of sample F. An entire lamella is attached to the replica on the left of the micrograph. This figure is printed as a negative.

The fracture process occurred both through the type III lamellae (right side of Figure 3) and between them (left side). In the latter case, entire lamellae often remained attached to the replica permitting the obtaining of single crystal electron diffraction patterns described in the next section. Although the striations could be observed on the fractured edges of the attached lamellae, the interlamellar surface was obscure. Apparently the large amount of attached polymer caused the replica to break up under the action of the beam. By limiting the beam current, as for the electron diffraction studies, somewhat better micrographs were obtained (Fig. 8), although at low magnification. These suggest that the thickness of a given lamella may vary somewhat, regions on the order of 1 μ^2 being of nearly uniform thickness. Although no obvious structure was present within these regions, further investigation at higher magnification would be useful.

Lamellae have been observed with thicknesses of up to 3 μ in samples E and F. The average thickness, from low magnification micrographs covering areas representative of the whole sample, is about 2500 A. The