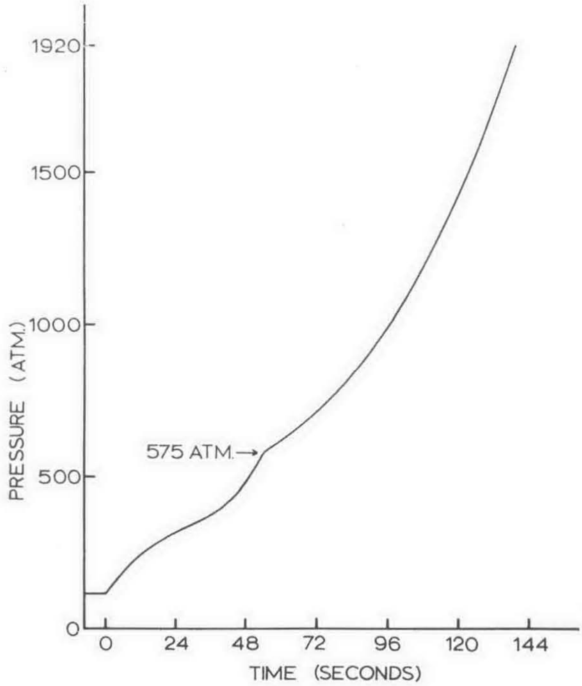

Fig. 1. Instron pressure trace at 136°C under a plunger velocity of 0.5 cm/min with a capillary of 0.0508 cm diameter, 1.55 cm length, and 90° entrance angle.

circumvented the melting that would have occurred at 136°C and atmospheric pressure.

Specimens were examined by scanning electron microscopy (SEM) as well as by direct transmission and replication electron microscopy (TEM). SEM specimens were prepared by fracturing the transparent strands longitudinally, vacuum-coating with 50 Å gold film, and then observing with a Cambridge Ultrascan instrument. TEM specimens were prepared using such techniques as one-step and two-step replication methods, ultramicrotomy with Br_2 staining, and selected-area electron diffraction. A Phillips EM 200 electron microscope equipped with a tilting stage and a Jeolco T7 electron microscope were used to observe the TEM specimens. Preparation and observational procedures will be further discussed as necessary in conjunction with specific micrographs.

RESULTS

Sample Appearance

The transparent strands were formed by a procedure that was similar to a drawing operation. In light of Peterlin's observation that extensive drawing causes localized melting during deformation,[15] it was anticipated that the restructured extruded strands would have a morphology different

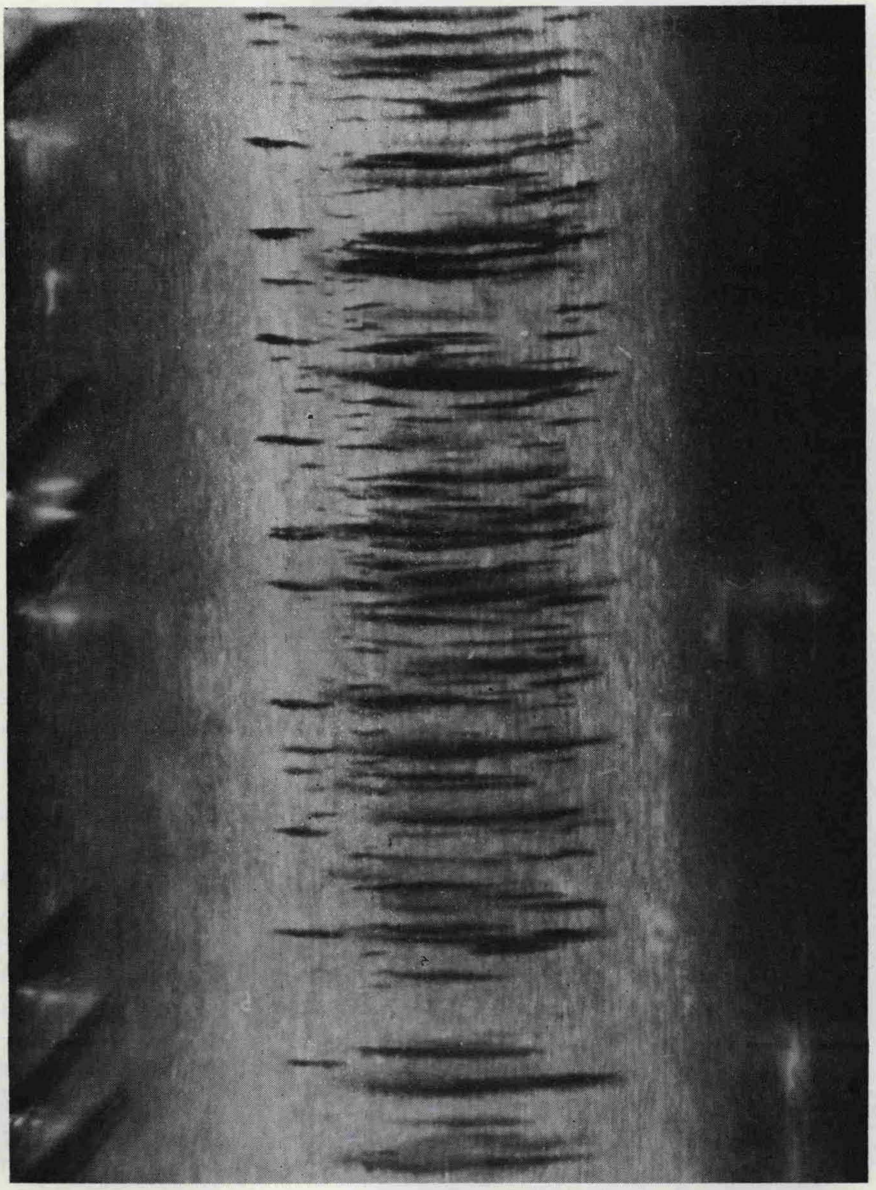

Fig. 2. Microcracks in a strand crystallized in the Instron rheometer at 131°C (optical micrograph).

than that of the polyethylene obtained from the reservoir. Furthermore, the transparent strands were not simply the result of crystallization directly from the flowing melt in the capillary. Indeed, transparent strands were also formed at 60°C by simply applying 1920 atm to a solid plug of polyethylene in the reservoir, forcing it into the capillary to form the unusual structure of the strand. However, the lower-temperature procedure often resulted