Shear-induced crystallization

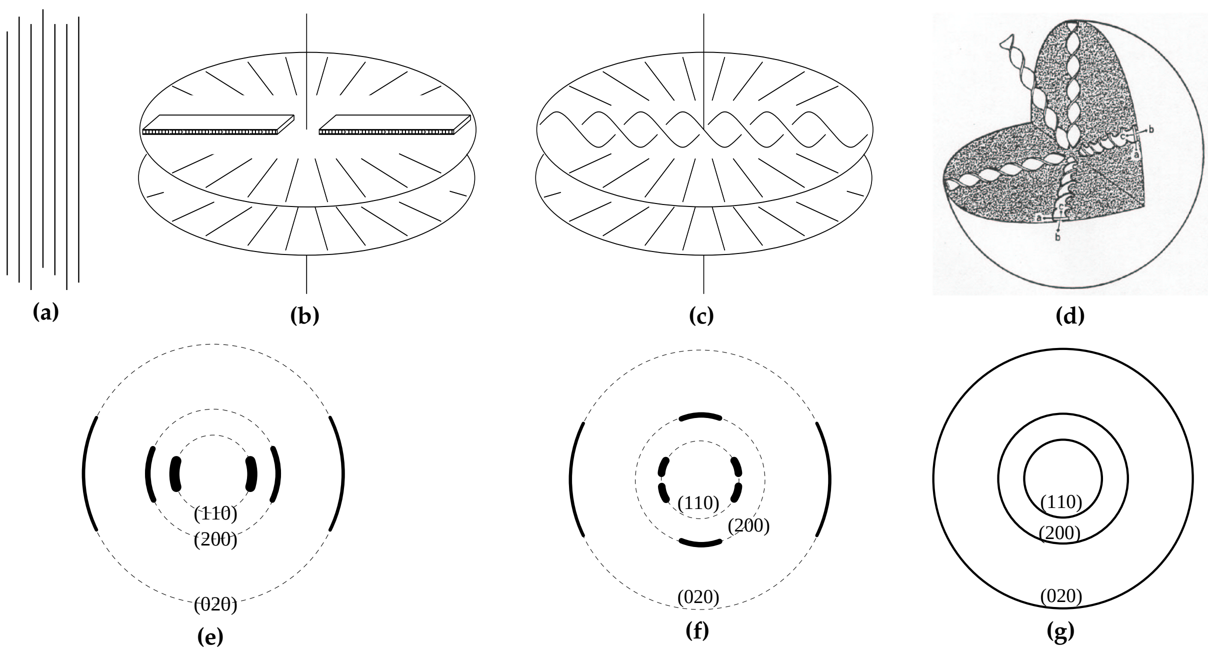
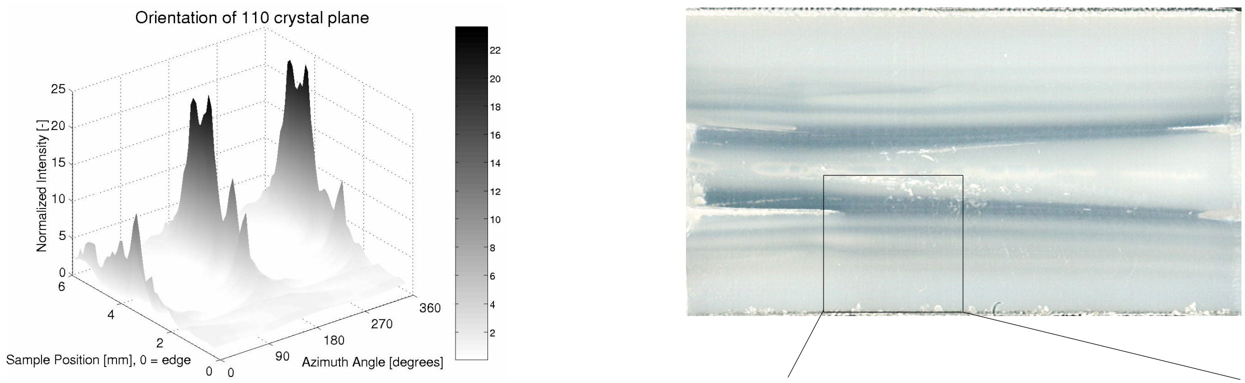
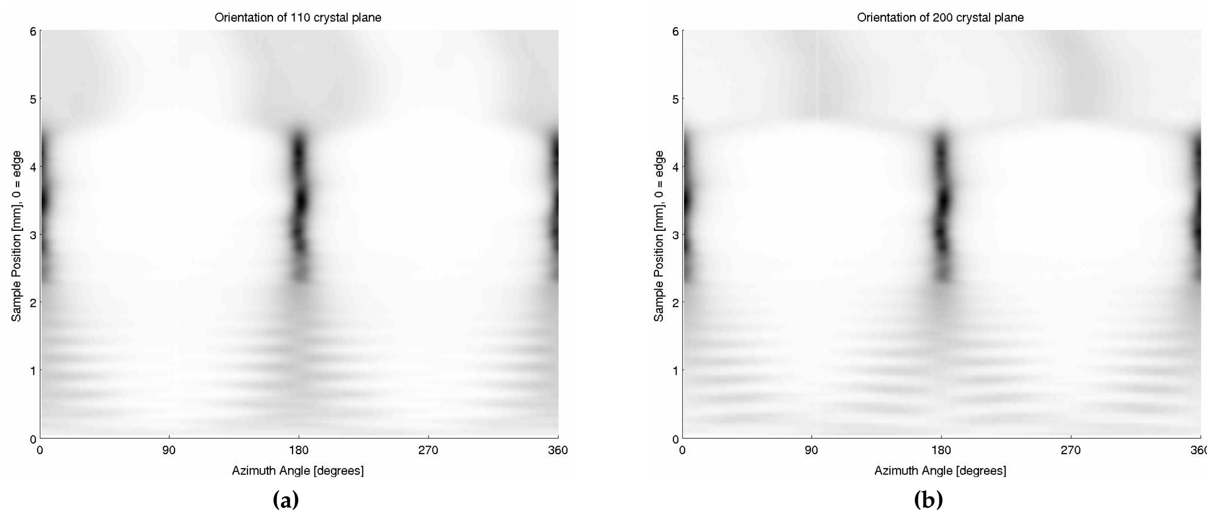


Figure 1: Schematic reprensentation of the crystal texture originating during orientation flow-induced crystallization of polymeric melts, shown for polyethylene. Details **(a)**, **(b)** and **(c)** show the effect of decreasing the strength of the orientation influences and detail **(d)** represents the sperulites, which arise in the absence of flow, i.e. under quiescent crystallization. Orientation generates fibrous crystals as shown in **(a)**. On weakening the orientating influence, fewer and hence more widely spaced fibers form, and intervening material subsequently crystallizes as platelet overgrowth. With a moderate fiber seperation the platelets are all essentially parallel **(b)**, but with a large fiber seperation, arising under a still weaker orienting influence, the platelets will twist **(c)**, as they would in spherulitic growth under stationary conditions, except here they are confined to planes normal to the fiber (hence flow) directions. These structures are called row structures **(c)**. The diffraction patterns **(e)**, **(f)** and **(g)** are sketches representing the main features of the three principal reflections in polyethylene. Pattern **(e)** refers to both structures **(a)** and **(b)**. Pattern **(f)** is the diffraction pattern for the row structure of **(c)**. The spherulites **(d)** show an isotropic pattern **(g)**.



(a) (b)

Figure 2: **(a)** 110 crystal-orientation over a sample width of 6 [mm], from edge to center of the sample. The peaks between 4 and 5 [mm] of the edge correspond to a region with highly oriented structures in the sample.
(b) Scan from a sample, produced with the MPR with a high piston speed, i.e. a high shear rate (sample thickness ± 2 [mm]). Dark regions are in reality transparent. Scan is made with dark background for a better contrast.



(a) (b)

Figure 3: **(a)** Top view of 110 crystal-orientation over a sample width of 6 [mm], from edge to center of the sample. This sample is prepared with a lower piston speed, i.e. a lower shear rate.
(b) Top view of 200 crystal-orientation. After the high peaks (dark regions) corresponding to the highly oriented structures, the flow is stopped. Here, a clear splitting of the peaks in the 110 crystal-orientation and a shifting of the peaks from 0 and 180 degrees to 90 and 270 degrees in the 200 crystal-orientation can be seen. This corresponds to row structures, Figure 1, which arise under a weak orienting influence.

References