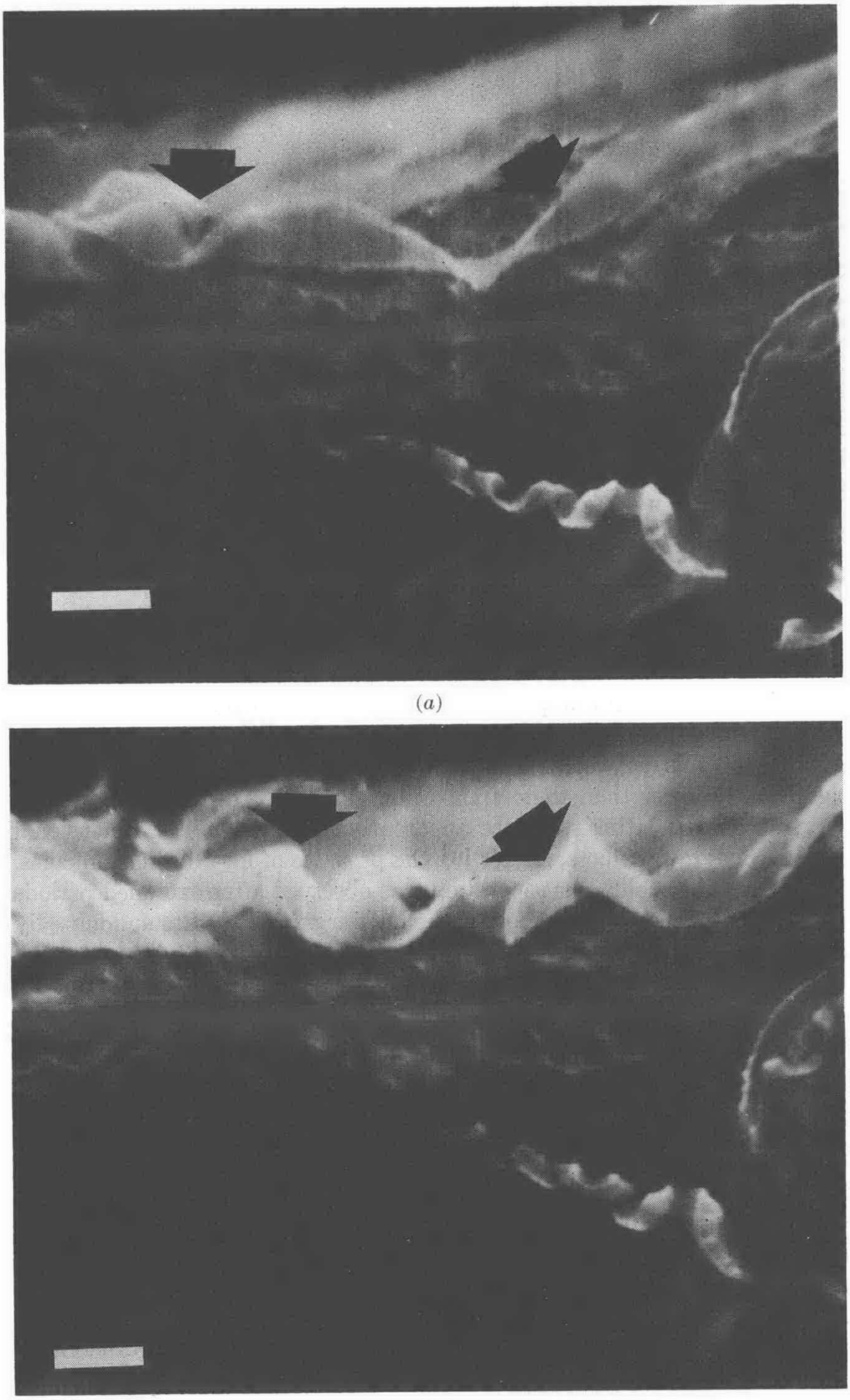

(a)

(b)

Fig. 5. Inner-core texture: (a) upon insertion into the microscope; (b) 10 min after insertion. Scanning electron micrographs: bar, 1μ.

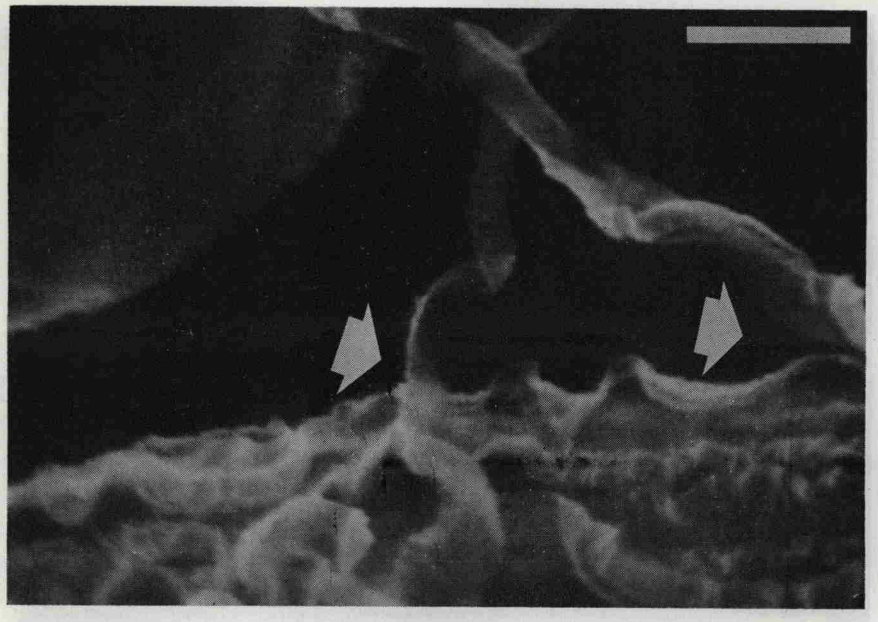

Fig. 6. Ribbons in the inner core. Scanning electron micrograph; bar, 1μ.

ribbon substructure will be described in connection with TEM since the thickness measurements approach the SEM resolution limit.

It should be mentioned that the ribbon coiling implies two important features of this particular morphology. First, inter-ribbon bonding is significantly lower than that of the outer sheath. The cross texture observed with the latter structure apparently imparts a three dimensional cohesiveness to the fibers, suggesting the presence of interfibrillar linkages. Indeed, no fiber coiling or separation was observed after extended periods in the SEM. Second, the ribbons in the bulk-crystallized state undoubtedly contained a significant residual strain which is apparently relieved by the coiling mechanism. Such residual strain may have had inherent crystallographic as well as shear-induced origins similar to those causing periodic twisting in polyethylene spherulites.[16]

Transmission Electron Microscopy

Specimens were examined in the conventional electron microscope using both fracture replication and direct transmission techniques. Fracture-surface replication proved somewhat difficult because of surface roughness. However, good quality replicas were obtained by shadowing the surface directly with Pt–C, evaporating a thin carbon layer, and finally stripping the layers with acetone–swollen acetate strips. The acetate was then removed by dissolving in amyl acetate, to leave a negative Pt–C shadowed carbon replica. Selected-area electron diffraction was performed on several polyethylene fiber fragments which fortunately adhered to such replicas.