appreciably from sample to sample as shown in Fig. 6. This is one of the new facts found by the lattice image method. In the case of the Coalinga sample, for instance, the percentage of the fibrils showing parallel fringes is about 20%. The synthetic sample showed a similar feature, as can be seen in Fig. 6. On the other hand, the sample from Quebec which was studied in the previous work (Yada, 1967) gave a fairly high percentage of 94% for the fibrils showing the parallel fringes, though its histogram is not included here. The samples from other sources gave intermediate values. It is seen that the angular distribution of the tilted 4·5 Å fringes shows a peak value at 2–3° and ranges up to about 10° depending on the source of the samples.

(b) Para-chrysotile and ortho-chrysotile

The existence of a small number of para-chrysotile fibrils (Whittaker, 1956*c*) was confirmed in certain samples (Globe and Tasmania) by observing the 4·5 Å fringes nearly perpendicular to the fibre axis, as was reported in the previous paper (Yada, 1967).

In principle, identification of ortho-chrysotile (Whittaker, 1956; Zussman, Brindley & Comer, 1957) would be possible by observing the 2·6 Å transverse fringes corresponding to 200, but, in practice, this was not possible because of the very poor contrast of this fringe system compared with the much higher contrast of the 7·3 Å fringes, crossing them. Diffraction patterns corresponding to ortho-chrysotile were rarely obtained. The results obtained on these para- and ortho-chrysotile fibrils will be reported in detail elsewhere.

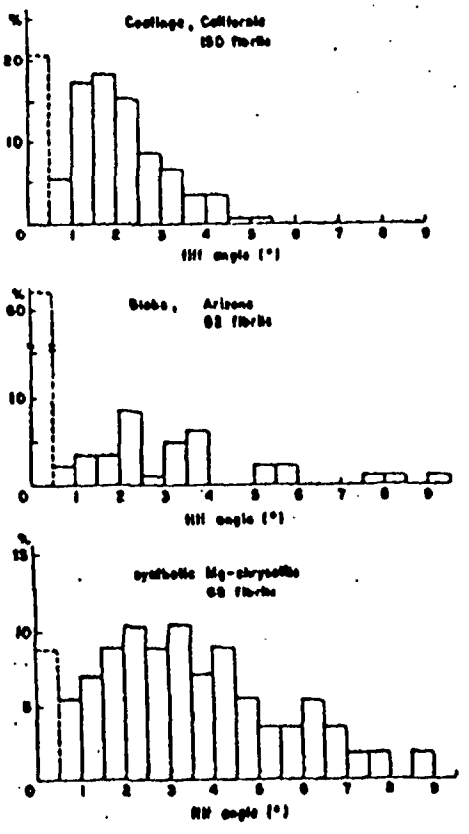

Fig. 6. Angular distribution of the frequency of the tilted 4·5 Å fringes.

(c) Growth patterns

Lattice images suggesting some new information about the growth mechanism were found at the growth end of the fibrils. Fig. 7 shows an example obtained from the Coalinga sample in which (*a*) is a low magnification image and (*b*) its enlargement. It is seen that the surface of the fibrils is quite clean on the molecular scale, without any amorphous material, and that the end of the fibril has a conical shape formed by steps of two or three sheets rolled up together. It is also seen that this conical fibril is considerably thicker at the bottom than at the top [the lower darkened area in (*a*)], which suggests a discontinuous step-growth as described later. Such a conically stepped structure was also observed inside a fibril as seen in Fig. 8 These observations seem to support the coupled dislocation mechanism proposed by Jagodzinski & Kunze (1954).

In the case of synthetic chrysotile, another type of cone-shaped fibrils was found in which the 7·3 Å fringes on opposite sides of a fibril are not parallel, as shown in Fig. 9. These two sets of 7·3 Å fringes make an angle of 3° for fibril *A* and of 5·5° for *B*. The 4·5 Å fringes in the middle of these fibrils are also tilted at a fairly large angle, to the fibre axis, though their fringe contrast is poor. This is illustrated in the drawing (*b*) which traces the fringe systems of *A* and *B* in (*a*). It is noted that the tilting of the two sets of the 4·5 Å fringes are asymmetrical about the fibre axis with an angular difference of a few degrees. This type of growth pattern seems to correspond to the cone-in-cone pattern which was reported by Bates & Comer (1957).

Observation from the direction parallel to the fibre axis

The general feature that most fibrils are hollow but a few are solid, was seen in the cross section of the samples from all the sources examined. Further observations revealed the following.

(a) Step-growth

Fig. 10 shows the cross section of a rather thick fibril from Coalinga indicating a two-step growth. The two or three-step growth was also observed in relatively thick fibrils in the samples from other sources. The frequency of such two- or three-step growth is different from sample to sample, and is particularly high in the specimen from Tasmania as shown in Fig. 11. It is seen that fibrils thicker than about 350 Å show traces of the stepwise growth. In the analysis of the distribution of the fibril diameter, therefore, such a stepwise growth should be taken into consideration.