International Tables for Crystallography (2010). Vol. B, Figure 2.5.3.12, p. 322.

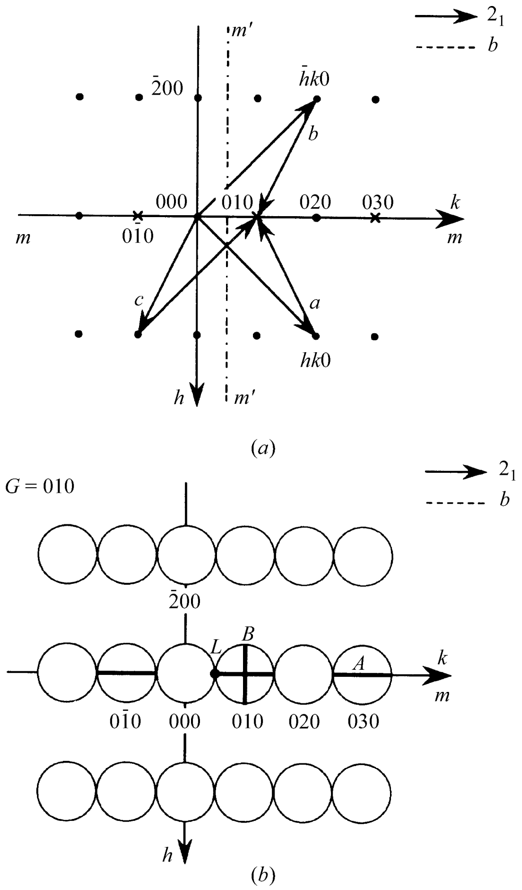

Fig. 2.5.3.10. Illustration of the production of dynamical extinction lines in kinematically forbidden reflections due to a b-glide plane and a 2_1 screw axis. (a) *Umweganregung* paths a, b and c. (b) Dynamical extinction lines A are formed in forbidden reflections $0k0$ (k = odd). Extinction line B perpendicular to the lines A is formed in the exactly excited 010 reflection.

In principle, a horizontal screw axis and a vertical glide plane can be distinguished by observations of the extinction lines A_3 and B_3. It is, however, not easy to observe the extinction lines A_3 and B_3 because broad extinction lines A_2 and B_2 appear at the same time. The presence of the extinction lines A_3 and B_3 can be revealed by inspecting the symmetries of fine defect HOLZ lines appearing in the forbidden reflections instead of by direct observation of the lines A_3 and B_3 (Tanaka, Sekii & Nagasawa, 1983). That is, if HOLZ lines form lines A_3 and B_3, HOLZ lines are symmetric with respect to the extinction lines A_2 and B_2. If HOLZ lines do not form lines A_3 and B_3, HOLZ lines are asymmetric with respect to the extinction lines A_2 and B_2. When the HOLZ lines are symmetric about the extinction lines A_2, the specimen crystal has a glide plane. When the HOLZ lines are symmetric with respect to lines B_2, a 2_1 screw axis exists. It should be noted that a relatively thick specimen area has to be selected to observe HOLZ lines in ZOLZ reflection discs.

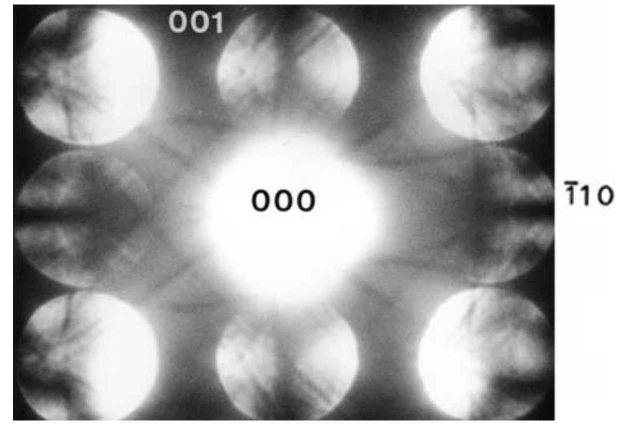

Fig. 2.5.3.12. CBED pattern of FeS_2 taken with the [110] electron-beam incidence. In the 001 and 00$\bar{1}$ discs, HOLZ lines are asymmetric with respect to extinction lines A_2, indicating the existence of a 2_1 screw axis parallel to the c axis. In the $\bar{1}10$ and $1\bar{1}0$ discs, HOLZ lines are symmetric with respect to extinction lines A_2, indicating existence of a glide plane perpendicular to the c axis.

Fig. 2.5.3.11 shows CBED patterns taken from (a) thin and (b) thick areas of FeS_2, whose space group is $P2_1/a\bar{3}$, at the 001 Bragg setting with the [100] electron-beam incidence. In the case of the thin specimen (Fig. 2.5.3.11a), only the broad dynamical extinction lines formed by the interaction of ZOLZ reflections are seen in the odd-order discs. On the other hand, fine HOLZ lines are clearly seen in the thick specimen (Fig. 2.5.3.11b). The HOLZ lines are symmetric with respect to both A_2 and B_2 extinction lines. This fact proves the presence of the extinction lines A_3 and B_3, or both the c glide in the (010) plane and the 2_1 screw axis in the c direction, this fact being confirmed by consulting Table 2.5.3.9. Fig. 2.5.3.12 shows a [110] zone-axis CBED pattern of FeS_2. A_2 extinction lines are seen in both the 001 and $\bar{1}10$ discs. Fine HOLZ lines are symmetric with respect to the A_2 extinction lines in the $\bar{1}10$ disc but asymmetric about the A_2 extinction line in the 001 disc, indicating formation of the A_3 extinction line only in the $\bar{1}10$ disc. This proves the existence of a 2_1 screw axis in the [001] direction and an a glide in the (001) plane. The appearance of HOLZ lines is easily changed by a change of a few hundred volts in the accelerating voltage. Steeds & Evans (1980) demonstrated for spinel changes in the appearance of HOLZ lines in the ZOLZ discs at accelerating voltages around 100 kV.

Another practical method for distinguishing between glide planes and 2_1 screw axes is that reported by Steeds *et al.* (1978). The method is based on the fact that the extinction lines are observable even when a crystal is rotated with a glide plane kept parallel and with a 2_1 screw axis perpendicular to the incident

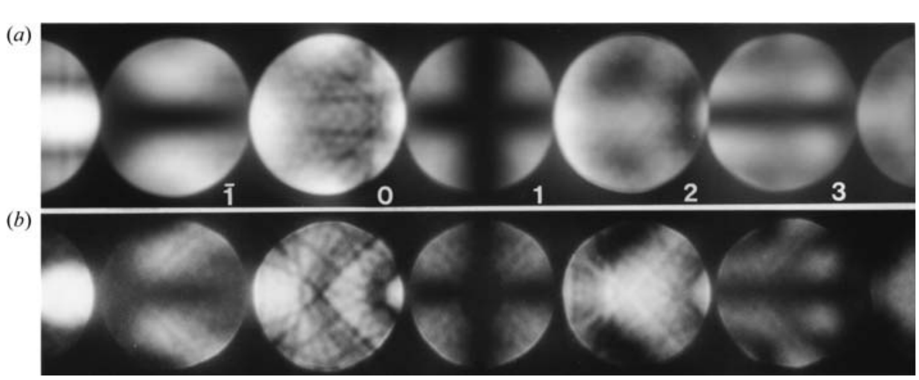

Fig. 2.5.3.11. CBED patterns obtained from (a) thin and (b) thick areas of (001) FeS_2. (a) Dynamical extinction lines A_2 and B_2 are seen. (b) Extinction lines A_3 and B_3 as well as A_2 and B_2 are formed because HOLZ lines are symmetric about lines A_2 and B_2.

  references