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Cleavage Device for Alkali Halides*

C. A. Pelá, J. X. De Oliveira, and Z. P. De Arguello

Instituto de Fisica CP. 1170, Universidade Estadual De Campinas, 13.100, Campinas, Sao Paulo, Brasil

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This Note describes a cleavage device for alkali halides. This device was used in our laboratories for crystals of NaCl, KCl, and LiF with very good results. For this last crystal special care should be taken due to its cleaving characteristics; this harder material is quite difficult to handle. Our success in cleaving LiF under vacuum makes perhaps of general interest a description of the cleaving device. The freshly vacuum cleaved surface offers the possibility of initial nucleation studies of evaporated single crystal thin films. In order to simultaneously meet the needs of heating and high vacuum, the device is made of stainless steel.

The device is shown in Figs. 1 and 2. It consists essentially of: I—holding plate, II—crystal holder, III—stainless steel cutting blade, IV—blade holder, V—hammer, VI—hammer trigger, VII—shutter mechanism. The crystal is indicated by VIII. The holding plate is used in order to fix the whole assembly at the desired place inside the bell jar in such a way that the crystal conveniently faces the evaporation source. The crystal holder keeps the crystal at an angle of 15° with the blade cutting edge. The small plates A and B can be changed in order to fit with precision the crystal size (~5×5×15 mm). The blade holder can be moved backwards and forwards by means of a slot in the holding plate. This adjustment is necessary to insure that the blade initially touches the crystal.

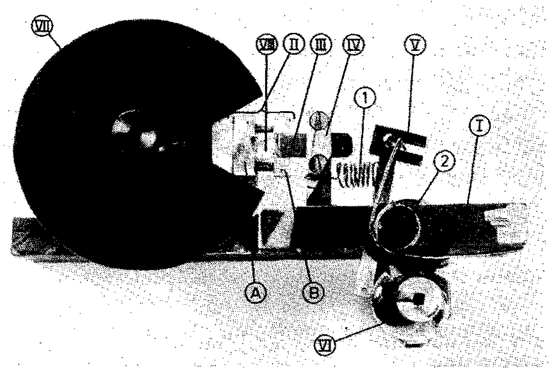

FIG. 1. Front view picture of the cleaving device. Parts description in the text.

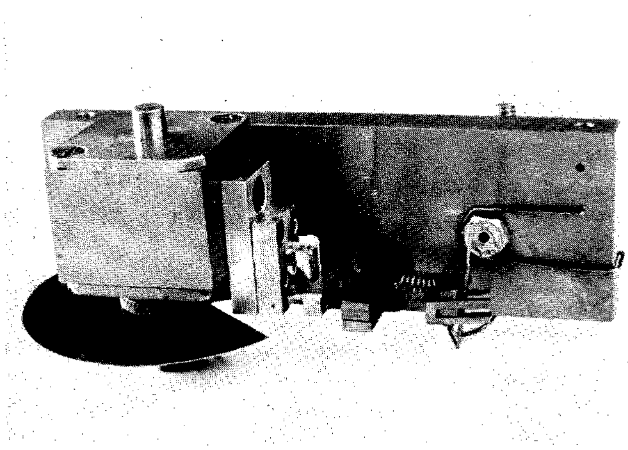

FIG. 2. Side view picture of the cleaving device.

The cleavage is accomplished by activating the hammer trigger with a speedometer cable, controlled from the outside of the bell jar using a commercial vacuum feedthrough. The blade is allowed to move by no more than 1 mm. We found that the cleavage of NaCl can be performed using only one spring at the trigger, namely spring 1, that has a constant of about 300 N/m. In order to cleave LiF one needs another spring 2 (spring constant ~0.3 N m/rad).

The cutting edge of the blade must be ~30°. If it is smaller than that, the blade's cutting edge is destroyed and no cleavage is possible. If the angle is larger, the crystal is broken instead of cleaved. This precaution is not so critical in case of the softer materials such as NaCl and KCl. However, when the precautions described above are taken, the rate of cleaving with the described cleaving device is practically 100%, even at temperatures higher than room temperature. This was observed up to 300°C.

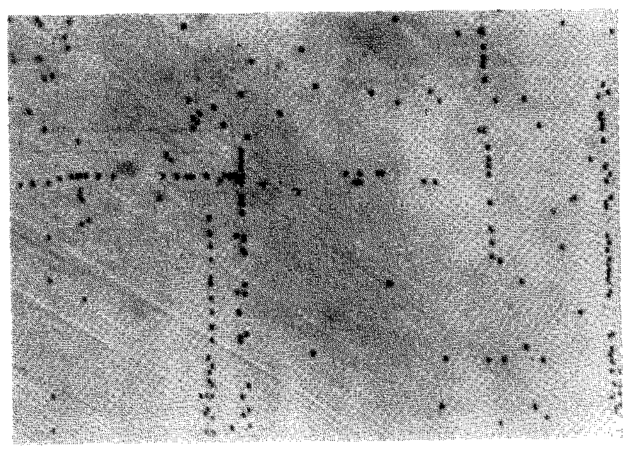

FIG. 3. Dislocations etchpits at a typical freshly cleaved LiF surface (100) face (90×).

To give an idea of the remelting surface, the dislocation etch pits at a typical freshly cleaved LiF surface are shown in Fig. 3 where the magnification is 90×.

The shutter mechanism is also activated from the outside by another speedometer cable through a vacuum feedthrough.

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