

LEED STUDY OF QUARTZ CRYSTALS

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No low energy electron diffraction data of quartz crystals have been reported yet, though it may have some interest from the point of view of preparing quartz-silicon heteroepitaxy^{1,2}. This letter is a preliminary account on observations made on $(10\bar{1}0)$, (0001) and $(10\bar{1}1)$ faces of quartz. The experiments were carried out in a Vacuum Generators LEED equipment Model LP-A in UHV. The crystals were first polished, and then etched in HF in order to remove the damaged layers. No further cleaning process was needed to obtain diffracted beams. The observed LEED patterns indicated a 1×1 type surface structure for all the three orientations studied.

Heat treatment resulted in gradual deterioration in the LEED patterns. In the cases of $(10\bar{1}0)$ and (0001) faces, the diffracted beams disappeared completely during a heat treatment of 5 min at approximately 550°C ; at 500°C the pattern disappeared in 1 hr. Surfaces of $(10\bar{1}1)$ orientation proved

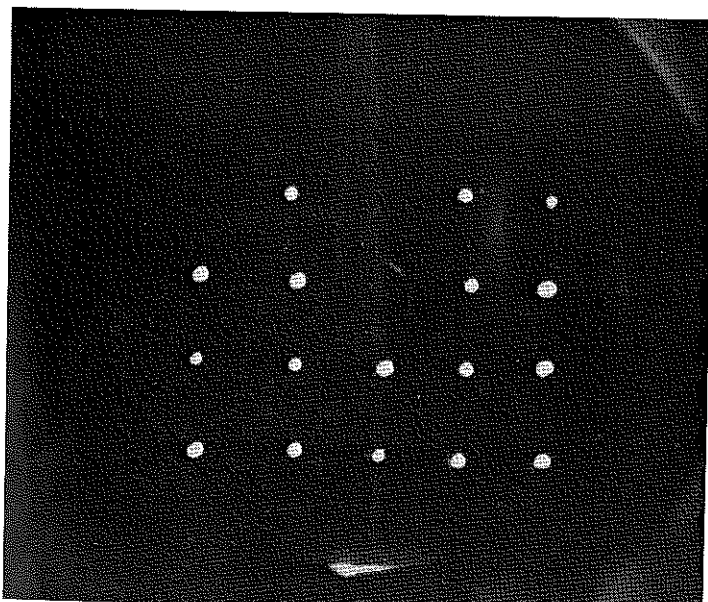
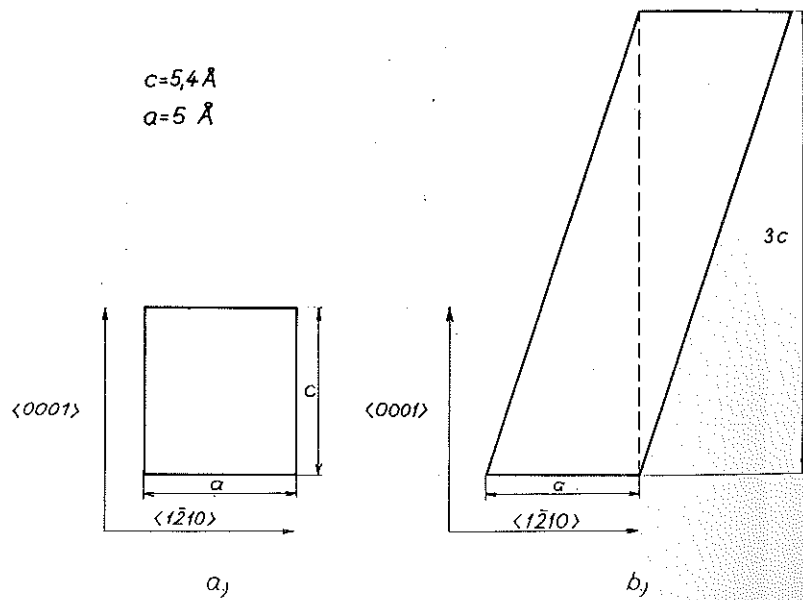


Fig. 1(a)



Fig. 1(b)

Fig. 1. LEED patterns of quartz $(10\bar{1}0)$ face. (a) 1×1 structure, (b) observed superstructure.Fig. 2. Surface unit meshes of quartz $(10\bar{1}0)$ face. (a) 1×1 structure, (b) observed superstructure.

to be more stable; at 600°C for 30 min significant deterioration in the patterns was observed, but the diffracted beams did not disappear even upon heating the crystals to 1000°C.

In one case, when investigating a sample of (10 $\bar{1}$ 0) orientation, the formation of a superstructure was observed on heating the crystal to 500°C. The LEED pattern of the 1 × 1 structure is shown in fig. 1a, that of the superstructure in fig. 1b. The corresponding surface unit meshes are shown in figs. 2a and 2b.

Deterioration of LEED patterns at each orientation could also be caused by the primary electron beam. The pattern disappeared in a minute at a current density of 10⁻⁵ A/cm². A similar effect was found on alkali halide crystals³⁾, but on quartz the heat treatment does not restore the diffraction pattern. The pattern could be restored only by removing a layer of 100 Å thickness by etching. More details will be published in *Acta Physica Hungarica*.

Discussions with Dr. G. Gergely are much appreciated. We are indebted to J. Pfeifer for preparing the samples and for helpful discussions.

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