CHAPTER VIII

ETCH PATTERNS ON \{COO\}_C CLEAVAGES
AND NON-BASAL DISLOCATIONS

8.1 Introduction

Generally in etching techniques cleavage faces are preferred to natural ones for the study of imperfections in crystalline bodies, whether perfectly or partially cleavable, because they are free from the usual growth features and other surface markings which may affect the etch patterns produced. It was, therefore, considered worthwhile to extend similar studies to silicon carbide cleavages.

8.2 The Etching Conditions

In the present investigations, commercial \(\alpha\) SiC crystals were mainly used. The cleavages were obtained as explained in chapter VII. A number of etchants were tried, so that both the faces of a matched pair would be attacked almost to the similar extent. As in the case of habit planes, during the flux etching, Si face (A face; Brack 1965) remained smooth and the C face (B face) turned wormy or matt. However, from a large number of experiments it was found that a mixture of fused alkalis of \(K_2CO_3 + Na_2CO_3\) (3 : 1 by weight; Horn 1952) in controlled conditions of temperature and time, was quite...
a suitable etchant for both the faces. It was important for the B face that the temperature was between 900 to 920°C and the etching time did not exceed $\frac{1}{2}$ mts. at a time. Though NaOH is reported to produce characteristic etch pits only on the A face (Lamport et. al. 1968), under controlled conditions the author could obtain a similar type of etching on the B face also. The attack of NaOH flux on the two faces with change of temperature is interesting and will be discussed in detail later.

8.3 Etching of Matched Faces

Figures 57a and 57b show the A and B faces of a matched pair etched simultaneously in Na$_2$CO$_3$ at 950°C for 3 mts. Apart from establishing from the shape of the pits that they were true (0001) cleavages, the following observations were made:

1. The etching has affected the two faces differently as expected. The cleavage lines in Fig. 57b are completely dissolved away while in Fig. 57a they are still present.

2. In Fig. 57b, in addition to the individual isolated pits, there are a large number of micropits which are completely missing in Fig. 57a.

3. Though there is perfect matched pit configuration, the shapes of the pits on the two faces differ slightly. Often the etching was so rapid on the B face...
that no visible etch pits were formed as shown in Fig. 58b which is the same region of Fig. 45b, after undergoing etching in Na$_2$CO$_3$ for $\frac{1}{2}$ mts. while Fig. 58a is its counterpart corresponding to the region in Fig. 45a after a 3 mts. etch. The effect of Na$_2$CO$_3$ on the A and B cleavages is clearly revealed by the interferograms in Figs. 59a and 59b respectively. The nature of the fringes reveals that the B face is more affected than the A face. Flux etches in Na$_2$CO$_3$ and borax also produced similar results.

Figures 60a and 60b show a pair of matched faces etched simultaneously in the carbonate mixture for $\frac{1}{2}$ mts. at 920°C. The pattern on the B face has considerably improved while there is no appreciable change in the etch patterns on A. The two faces have undergone dissolution almost to the same extent. These faces were further etched for another $\frac{1}{2}$ mts. (Figs. 61a and 61b). The results of additional etching carried out on the face in Fig. 61a for $\frac{1}{2}$ and 3 mts. are recorded in Figs. 62a and 62b respectively. The salient features are:

1. The dark band running across both the cleavage faces is a large cleavage step which has moved due to the preferential attack on its ledges.

2. In Figs. 60a and 60b almost all pits are point bottomed and some of them are asymmetric.