

## C O N T E N T S

### PART I

<u>CHAPTER I</u>	<u>EXISTING INFORMATION ON DIAMOND</u>	<u>PAGE</u>
1.1	Introduction	1
1.2	Historical review	2
1.3	Occurrence	3
1.4	Form and shape	5
1.5	Crystal structure and symmetry properties	6
1.6	Cleavage	9
1.7	Classification of diamonds	11
1.8	Physical properties	
	i    General	13
	ii   Optical and other special properties	16
	iii  Thermal properties	19
1.9	Chemical properties	19
1.10	Uses	20

### PART II

<u>CHAPTER II</u>	<u>EXPERIMENTAL TECHNIQUES</u>	
2.1	Introduction	24
2.2	Silvering technique	24

2.3	Vickers projection microscope	27
2.4	Olympus universal metallurgical microscope	28
2.5	Multiple beam interferometry	30
2.6	Fringes of equal chromatic order (F. E. C. O.)	37
2.7	Light profile microscopy	40
2.8	Phase contrast microscopy (theory)	44
2.9	The method	46
2.10	Replica technique for electron microscopy	48
2.11	Etching technique	
	i Slow etching	49
	ii Fast etching	51

### PART III

#### CHAPTER III

#### THE MICROSTRUCTURES OF DIAMOND SURFACES

3.1	Introduction	53
3.2	A review of the existing information	54

<u>CHAPTER IV</u>	<u>MICROSTRUCTURES ON PANNA DIAMOND SURFACES</u>	
4.1	Introduction	65
4.2	Microstructures on crystal no. 4	66
4.3	Microstructures on crystal no. 15	67
4.4	Microstructures on crystal no. 10	68
4.5	Microstructures on crystal nos. 11 and 20	69
4.6	Microstructures on a South African octahedron	70
4.7	Conclusions	72
<u>CHAPTER V</u>	<u>TRIGONS ON OCTAHEDRAL CLEAVAGES OF PANNA DIAMONDS</u>	
5.1	Introduction	75
5.2	Trigon pattern on the matched faces of a Panna crystal	75
5.3	Cause of the formation of the trigon pattern	77
5.4	Orientation of the triangular pattern	80
5.5	The microstructures on the dodecahedral faces of the crystal	80
5.6	Discussion	81

<u>CHAPTER VI</u>	<u>UNUSUAL MICROSTRUCTURES ON SOME UNION SOUTH AFRICAN NATURAL DIAMONDS</u>	
6.1	Introduction	83
6.2	Microstructures on crystal no. 10	83
6.3	Microstructures on crystal no. 5	85
6.4	Production of triangular elevations in the laboratory	86
6.5	Conclusions	87
<u>CHAPTER VII</u>	<u>ELECTRON OPTICAL STUDIES OF TRIGONS</u>	
7.1	Introduction	88
7.2	Observations	89
7.3	Discussions	90
<u>CHAPTER VIII</u>	<u>SLIP AND SCREW DISLOCATIONS IN DIAMOND</u>	
8.1	Introduction	95
8.2	Observations	96
	i Slip line on $(\bar{1}11)$ face	97
	ii Slip line on $(1\bar{1}1)$ face	99
	iii Non linear line on $(111)$ face	101
8.3	Discussion	101

PART IV

<u>CHAPTER IX</u>	<u>ETCHING AND DISSOLUTION</u>	
9.1	Etching	104
9.2	Historical review of the development of the etch method	104
<u>CHAPTER X</u>	<u>ETCHING OF DIAMONDS</u>	
10.1	Introduction	114
10.2	A review of the existing information	114
<u>CHAPTER XI</u>	<u>FAST ETCHING OF DIAMOND SURFACES</u>	
11.1	Production of trigon pattern on (111) faces	124
11.2	Formation of etch hillocks on (111) faces	130
11.3	Terraced pits on (100) faces	135
<u>CHAPTER XII</u>	<u>MICRO-DISC PATTERNS ON (110) AND (111) FACES</u>	
12.1	Introduction	137
12.2	Micro-disc patterns on (110) faces of diamond	139
12.3	Micro-disc pattern on (111) cleavage faces	141
12.4	Conclusions	143
<u>CHAPTER XIII</u>	<u>STUDIES ON ETCH RATES OF DIFFERENT FACES OF DIAMONDS</u>	
13.1	Introduction	145

13.2	Etching of crystal no. 1	146
13.3	Etching of crystal no. 2	151
13.4	Etching of the cleavage faces from different sources	155
13.5	Conclusions	160
<u>CHAPTER XIV</u>	<u>CLEAVAGE AND ETCHING OF DIAMOND BOARDS</u>	
14.1	Introduction	162
14.2	Interferometric study of the cleavage faces	162
14.3	Etching of the cleavage faces	163
14.4	Stratigraphical etch patterns	169
14.5	Conclusions	169
<u>APPENDIX A</u>	<u>CLEAVAGE AND ETCHING OF PRISM FACES OF APATITE</u>	
A.1	Introduction	171
A.2	Experimental	172
A.3	(10 $\bar{1}$ 0) cleavages and their etch patterns	173
A.4	Etch pattern on matched cleavage faces	176
A.5	Rectilinear etch patterns	177
A.6	Conclusions	180

APPENDIX BFISSION TRACKS AND LOW ANGLE TILT  
BOUNDARIES ON (1010) CLEAVAGES OF  
NATURAL APATITE CRYSTALS

B.1	Introduction	182
B.2	Experimental	183
B.3	Observations of fission tracks	183
B.4	Low angle tilt boundaries	187
B.5	Discussions and conclusions	189

REFERENCES