Table 2 (*cont.*)

22	*vs*		58·28
25	*a*		0·019
−2	*vw*		2·13
−5	*w*		5·37
−8	*a*		0·004
−11	*s*		29·72
−14	*w*		7·11
−17	*vvs*		100·00
−20	*s*	(−20 > −23)	40·17
−23	*s*		29·24
−26	*m*		10·73

References

BRAFMAN, O., ALEXANDER, E. & STEINBERGER, I. T. (1967). *Acta Cryst.* **22**, 347.

HAUPTMANOVÁ, K. & PÁTEK, K. (1963). *Phys. Stat. Sol.* **3**, 383.

KIFLAWI, I., MARDIX, S. & STEINBERGER, I. T. (1969). *Acta Cryst.* To be published.

MARDIX, C. (1966). M. Sc. Thesis, The Hebrew Univ., Jerusalem.

MARDIX, S., ALEXANDER, E., BRAFMAN, O. & STEINBERGER, I. T. (1967). *Acta Cryst.* **22**, 808.

Acta Cryst. (1969). B**25**, 2415

New double polytype region in a zinc sulphide needle.

By I. KIFLAWI and S. MARDIX, *Department of Physics, The Hebrew University, Jerusalem, Israel*

(*Received* 19 *February* 1969)

Eleven new polytypes were found in a zinc sulphide needle. Two of them, 24*L* (6 5 3 5 3 2) and 72*R* (6 5 3 3 5 2)₃ were contained in a double polytype region.

The concept of a double polytype region was introduced in a previous publication (Mardix, Kiflawi & Kalman 1969). It is a region of uniform birefringence containing a great number of narrow domains belonging to two different polytypes. The formation of this kind of region was explained by a periodic slip process (Mardix, Kalman & Steinberger, 1968) propagating with the same periodicity in both directions of the *c* axis. The components of the three double polytype regions previously reported were rhombohedral polytypes, whilst the double polytype region reported in this work consists of a mixture of two polytypes; one rhombohedral 72*R* $(653352)_3$ and the other hexagonal 24*L* (653532). These polytypes can be formed from the parent polytype 72*R* $(653442)_3$ by a single slip of the 19th layer propagating with a periodicity of 24 in both directions of the *c* axis. The two polytypes have only one pair of successive Zhdanov numbers different in their Zhdanov sequences, in agreement with the properties of this kind of polytype region stated in the above mentioned work.

The needle No. 106/34 investigated in this work was grown from the vapour phase at approximately 1200° C from pure ZnS powder. It contains single polytype regions as well as the double polytype region. The average diameter of the needle is 0·25 mm and it has a large hole along its *c* axis. A list of the polytypes found is given in Table 1. Eleven of them are new polytypes. Observed and calculated intensity distributions of the new polytypes are compared in Table 2. Their X-ray oscillation photographs are shown in Fig. 1. The procedure of identification is similar to that decribed elsewhere (Mardix, Alexander, Brafman & Steinberger, 1967).

Table 1. *Polytypes found in specimen* 106/34

Region	New polytypes found	Other polytypes found
a	72*R* $(6\ 5\ 3\ 3\ 5\ 2)_3$ / 24*L* (6 5 3 5 3 2)	
b	72*R* $(6\ 3\ 5\ 6\ 2\ 2)_3$	
c	24*L* (2 2 6 2 2 2 6 2 2)	
d	72*R* $(10\ 7\ 3\ 4)_3$	
e	72*R* $(11\ 5\ 5\ 3)_3$	
f, *g*, *h*	72*R* $(7\ 3\ 5\ 2\ 5\ 2)_3$	
i	72*R* $(9\ 3\ 5\ 3\ 2\ 2)_3$	
j	72*R* $(14\ 5\ 2\ 3)_3$	
k	24*L* (21 3)	
l	72*R* $(14\ 5\ 3\ 2)_3$	
m		24*L* (7 5 5 7)*

* Previously reported (Mardix, Brafman & Steinberger, 1967).

Table 2. *Comparison of the observed and calculated intensities of the new polytypes*

l	Obs.		Calc.
72*R* $(6\ 5\ 3\ 3\ 5\ 2)_3$			
1	*vw*		2·56
4	*vw*		2·43
7	*vvw*		0·190
10	*w*		5·37
13	*m*	(13 > 34)	12·41
16	*w*		5·21
19	*m*		17·30
22	*vvs*		100·00
25	*vw*		2·70
28	*s*	(28 > 31)	34·54
31	*s*		27·62
34	*m*		9·62
−2	*vvw*		0·977
−5	*w*		4·72
−8	*vw*		2·35
−11	*m*		10·50
−14	*m*	(−14 ~ −11)	12·67
−17	*m*		13·05
−20	*vw*	(−20 > −8)	3·45
−23	*vs*		52·31
−26	*s*		22·07
−29	*vw*		2·45
−32	*s*		25·20
−35	*vw*		2·44

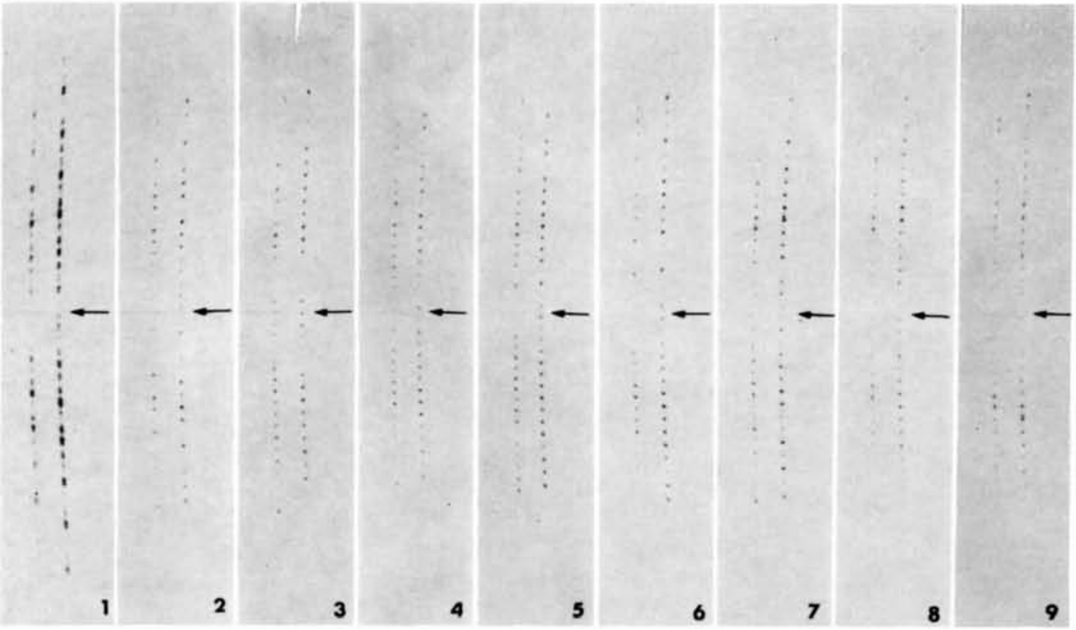

Fig. 1. (10.*l*) row lines of oscillation photographs about the *c* axis of the new polytypes. Cu *K* radiation. 60 mm diameter camera. Magnification x2·5. The zero lines are indicated by arrows.

No.		Polytype	
1	Double polytype	72*R* (6 5 3 3 5 2)$_3$	
		24*L* (6 5 3 5 3 2)	
2		72*R* (6 3 5 6 2 2)	
3		42*L* (2 2 6 2 2 6 2 2)	
4		72*R* (10 7 3 4)$_3$	
5		72*R* (11 5 5 3)$_3$	
6		72*R* (7 3 5 2 5 2)$_3$	
7*		72*R* (9 3 5 3 2 2)$_3$	
8*		72*R* (14 5 2 3)$_3$	
9		24*L* (21 3)	photographed
		& 72*R* (14 5 3 2)$_3$	simultaneously

* These photographs contain also reflexion spots from very narrow adjacent regions of unidentified polytypes.

Table 2 (*cont.*)

l	Obs.	Calc.
24*L* (6 5 3 5 3 2)		
0	*a*	0·00
1	*vvw*	0·275
2	*m*	10·47
3	*vw*	2·18
4	*vw*	3·46
5	*s*	26·91
6	*w*	5·62
7	*w*	6·17
8	*vvs* (8 > −7)	100·00
9	*w*	5·90
10	*w*	5·23
11	*s*	25·10
12	*vw*	6·17
−1	*vw* (−1 > 4)	3·91
−2	*vvw*	1·05
−3	*vvw* (−3 > −2)	2·18
−4	*m*	13·84
−5	*w*	4·67
−6	*w* (−6 > −5)	5·62
−7	*vvs*	87·82
−8	*w*	6·25
−9	*w*	5·90
−10	*vs*	52·26
−11	*vw* (−11 > −12)	4·36
−12	*vw*	3·45
72*R* (6 3 5 6 2 2)$_3$		
1	*w*	2·75
4	*m* (4 > 10)	5·67
7	*w* (7 > 1)	3·08
10	*m*	5·00
13	*m*	5·81
16	*s* (16 > −5)	17·00
19	*s* (19 > 16)	22·66
22	*vvs*	74·62
25	*vw*	1·44
28	*vs*	28·11
31	*vs*	29·82
34	*s*	11·43
−2	*vw*	1·56
−5	*s*	10·39
−8	*vvw*	0·192
−11	*w* (−11 > −14)	3·69
−14	*w* (−14 ∼ 1)	3·03
−17	*vs*	41·89
−20	*m*	6·38
−23	*vvs*	100·00
−26	*vs*	33·10
−29	*vvw*	0·881
−32	*vs*	44·40
−35	*a*	0·152
24*L* (2 2 6 2 2 6 2 2)*		
0	*w*	6·89
1	*s*	20·95
2	*vw*	3·55
3	*vvw*	1·08
4	*a*	0·00
5	*m*	13·01
6	*vs*	61·91
7	*vvs*	100·00
8	*m*	14·12
9	*s* (9 > 8)	17·07
10	*s* (10 ∼ 9)	17·70
11	*vs*	57·08
12	*m*	13·14

* The observed intensities are symmetrical with regard to the zero line ($l=0$).

Table 2 (*cont.*)

l	Obs.	Calc.
72*R* (10 7 3 4)$_3$		
1	*w*	2·45
4	*vvw*	0·145
7	*vw*	1·20
10	*m* (10 > 13)	5·65
13	*m*	4·43
16	*s*	18·38
19	*m* (19 ∼ 13)	4·95
22	*vs*	47·71
25	*vvs*	76·37
28	*w*	2·59
31	*s*	19·50
34	*m*	4·86
−2	*vvw* (−2 > 4)	0·360
−5	*m*	4·41
−8	*vw* (−8 > 7)	1·53
−11	*w*	3·82
−14	*m* (−14 ∼ 10)	6·60
−17	*m*	5·00
−20	*vs*	53·33
−23	*s* (−23 > 16)	33·85
−26	*vvs* (−26 > 25)	100·00
−29	*w*	3·95
−32	*w*	3·78
−35	*m*	9·08
72*R* (11 5 5 3)$_3$		
1	*vw* (1 > 4)	1·54
4	*vw*	0·927
7	*vw*	1·12
10	*vw* (10 > 7)	1·60
13	*m*	7·83
16	*w*	4·21
19	*m*	10·05
22	*vs*	29·40
25	*vw* (25 > 10)	2·45
28	*s* (28 > 31)	20·19
31	*s*	11·62
34	*vvw*	0·735
−2	*vw*	0·870
−5	*vvw* (−5 > −11)	0·560
−8	*w*	2·95
−11	*vvw*	0·148
−14	*m*	10·90
−17	*w* (−17 > −8)	4·02
−20	*w* (−20 > −17)	6·42
−23	*vvw*	100·00
−26	*vs* (−26 > 22)	40·20
−29	*s*	14·45
−32	*w* (−32 > −35)	5·24
−35	*w*	4·59
72*R* (7 3 5 2 5 2)$_3$		
1	*w*	3·98
4	*vvw*	0·590
7	*vw*	1·66
10	*vw* (10 > 7)	1·91
13	*vw* (13 > 10)	2·84
16	*w*	3·39
19	*s* (19 > −20)	33·28
22	*vvs*	100·00
25	*m* (25 > 28)	20·83
28	*m*	12·62
31	*vs*	47·05
34	*w*	2·74
−2	*w*	4·52
−5	*vvw*	0·486
−8	*vvw* (−8 > −5)	1·12
−11	*m* (−11 > −32)	19·54
−14	*vvw*	0·461

Table 2 (*cont.*)

−17	*vvw* (−17 > −14)	1·05
−20	*s*	24·54
−23	*w*	4·39
−26	*w* (−26 > −23)	4·72
−29	*m*	11·76
−32	*m* (−32 > −29)	13·32
−35	*vw*	2·60
l	Obs.	Calc.
72*R* (9 3 5 3 2 2)$_3$		
1	*vw* (1 > 7)	1·33
4	*w* (4 > 10)	4·58
7	*vw*	0·898
10	*w*	3·21
13	*m*	9·95
16	*w*	4·54
19	*s*	21·13
22	*s* (22 > 19)	18·34
25	*vw*	1·08
28	*w*	3·35
31	*s*	20·52
34	*w*	3·11
−2	*vvw* (−2 > −11)	0·674
−5	*w* (−5 > −8)	4·38
−8	*w*	3·17
−11	*vvw*	0·401
−14	*s* (−14 > −10)	14·19
−17	*m*	7·32
−20	*s*	9·79
−23	*vvs*	100·00
−26	*vs*	30·36
−29	*s*	11·76
−32	*w* (−32 > −5)	5·64
−35	*s*	17·31
72*R* (14 5 2 3)$_3$		
1	*w*	1·43
4	*w* (4 > 1)	2·13
7	*vvw*	0·274
10	*w*	1·97
13	*vvw* (13 > 7)	0·760
16	*w*	4·01
25	*w*	3·74
28	*m*	7·14
31	*s*	16·27
34	*m*	7·17
−2	*vvw* (−2 > 7)	0·690
−5	*vvw*	0·450
−8	*w*	2·80
−11	*m* (−11 > −32)	7·67
−14	*w*	2·79
−17	*vw*	1·22
−20	*w* (−20 > −29)	3·22
−23	*vvs* (−23 > −26)	100·00
−26	*vvs*	50·01
−29	*w*	1·96
−32	*m*	4·98
−35	*vw*	1·47
24*L* (21 3)		
0	*a*	0·000
1	*vvw*	0·090

Table 2 (*cont.*)

2	*vw*	0·342
3	*vw* (3 > 2)	0·711
4	*w*	1·13
5	*w* (5 > 4)	1·53
6	*w* (6 > 5)	1·84
7	*w* (7 > 6)	2·01
8	*w* (8 > 7)	2·04
9	*w* (9 > 10)	1·93
10	*w* (10 > 11)	1·71
11	*w* (11 > 12)	1·42
12	*w*	1·13
−1	*vvw*	0·090
−2	*vw*	0·342
−3	*vw* (−3 > −2)	0·711
−4	*w*	1·13
−5	*w* (−5 > −4)	1·53
−6	*w* (−6 > −5)	1·84
−7	*w* (−7 > −6)	2·01
−8	*vvs*	100·00
−9	*w* (−9 > −10)	1·93
−10	*w* (−10 > −11)	1·71
−11	*w* (−11 > −12)	1·42
−12	*w*	1·13
l	Obs.	Calc.
72*R* (14 5 3 2)$_3$		
1	*w*	1·74
4	*vw* (4 > 7)	0·966
7	*vw*	0·851
10	*w*	2·39
13	*w* (13 > 10)	3·14
16	*w* (16 > 13)	4·39
19	*w* (19 ~ 10)	3·51
22	*vvs*	100·00
25	*vs*	54·13
28	*s*	21·04
31	*s*	13·82
34	*vw*	2·88
−2	*vvw*	0·014
−5	*w*	3·13
−8	*w* (−8 > −11)	3·07
−11	*w*	2·71
−14	*m*	7·94
−17	*w*	3·55
−20	*m*	6·69
−23	*s*	23·99
−26	*s*	18·51
−29	*w*	2·80
−32	*m*	5·46
−35	*m*	6·43

References

Mardix, S., Alexander, E., Brafman, O. & Steinberger, I. T. (1967). *Acta Cryst.* **22**, 808.

Mardix, S., Brafman, O. & Steinberger, I. T. (1967). *Acta Cryst.* **22**, 805.

Mardix, S., Kalman, Z. H. & Steinberger, I. T. (1968). *Acta Cryst.* A**24**, 464.

Mardix, S., Kiflawi, I. & Kalman, Z. H. (1969). *Acta Cryst.* B**25**, 1586.