

**C222**

No. 21

**C222**
**D<sub>2</sub><sup>6</sup>**
**Generators selected** (1);  $t(1,0,0)$ ;  $t(0,1,0)$ ;  $t(0,0,1)$ ;  $t(\frac{1}{2},\frac{1}{2},0)$ ; (2); (3)

**General position**

 Multiplicity,  
Wyckoff letter,  
Site symmetry

**Coordinates**
 $(0,0,0)+$   $(\frac{1}{2},\frac{1}{2},0)+$ 

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 (1)  $x,y,z$  (2)  $\bar{x},\bar{y},z$  (3)  $\bar{x},y,\bar{z}$  (4)  $x,\bar{y},\bar{z}$ 
**I Maximal translationengleiche subgroups**

[2] C121 (5)	(1; 3)+	
[2] C211 (5, C121)	(1; 4)+	– <b>b, a, c</b>
[2] C112 (3, P112)	(1; 2)+	$1/2(\mathbf{a}-\mathbf{b}), 1/2(\mathbf{a}+\mathbf{b}), \mathbf{c}$

**II Maximal klassengleiche subgroups**

## • Loss of centring translations

[2] P2 <sub>1</sub> 2 <sub>1</sub> 2 (18)	1; 2; (3; 4) + $(\frac{1}{2}, \frac{1}{2}, 0)$		
[2] P2 <sub>1</sub> 22 (17, P222 <sub>1</sub> )	1; 3; (2; 4) + $(\frac{1}{2}, \frac{1}{2}, 0)$	<b>b, c, a</b>	0, 1/4, 0
[2] P22 <sub>1</sub> 2 (17, P222 <sub>1</sub> )	1; 4; (2; 3) + $(\frac{1}{2}, \frac{1}{2}, 0)$	<b>c, a, b</b>	1/4, 1/4, 0
[2] P222 (16)	1; 2; 3; 4		

## • Enlarged unit cell

[2] $\mathbf{c}' = 2\mathbf{c}$			
I2 <sub>1</sub> 2 <sub>1</sub> 2 <sub>1</sub> (24)	$\langle 3; 2 + (0,0,1) \rangle$	<b>a, b, 2c</b>	3/4, 0, 0
I2 <sub>1</sub> 2 <sub>1</sub> 2 <sub>1</sub> (24)	$\langle (2; 3) + (0,0,1) \rangle$	<b>a, b, 2c</b>	3/4, 0, 1/2
I222 (23)	$\langle 2; 3 \rangle$	<b>a, b, 2c</b>	
I222 (23)	$\langle 2; 3 + (0,0,1) \rangle$	<b>a, b, 2c</b>	0, 0, 1/2
C222 (21)	$\langle 2; 3 \rangle$	<b>a, b, 2c</b>	
C222 (21)	$\langle 2; 3 + (0,0,1) \rangle$	<b>a, b, 2c</b>	0, 0, 1/2
C222 <sub>1</sub> (20)	$\langle 3; 2 + (0,0,1) \rangle$	<b>a, b, 2c</b>	0, 0, 1/2
C222 <sub>1</sub> (20)	$\langle (2; 3) + (0,0,1) \rangle$	<b>a, b, 2c</b>	
[3] $\mathbf{a}' = 3\mathbf{a}$			
{ C222 (21)	$\langle 2; 3 \rangle$	<b>3a, b, c</b>	
{ C222 (21)	$\langle (2; 3) + (2,0,0) \rangle$	<b>3a, b, c</b>	1, 0, 0
{ C222 (21)	$\langle (2; 3) + (4,0,0) \rangle$	<b>3a, b, c</b>	2, 0, 0
[3] $\mathbf{b}' = 3\mathbf{b}$			
{ C222 (21)	$\langle 2; 3 \rangle$	<b>a, 3b, c</b>	
{ C222 (21)	$\langle 3; 2 + (0,2,0) \rangle$	<b>a, 3b, c</b>	0, 1, 0
{ C222 (21)	$\langle 3; 2 + (0,4,0) \rangle$	<b>a, 3b, c</b>	0, 2, 0
[3] $\mathbf{c}' = 3\mathbf{c}$			
{ C222 (21)	$\langle 2; 3 \rangle$	<b>a, b, 3c</b>	
{ C222 (21)	$\langle 2; 3 + (0,0,2) \rangle$	<b>a, b, 3c</b>	0, 0, 1
{ C222 (21)	$\langle 2; 3 + (0,0,4) \rangle$	<b>a, b, 3c</b>	0, 0, 2

## • Series of maximal isomorphic subgroups

[ <i>p</i> ] $\mathbf{a}' = p\mathbf{a}$			
C222 (21)	$\langle (2; 3) + (2u, 0, 0) \rangle$	<b>pa, b, c</b>	<i>u</i> , 0, 0
	$p > 2; 0 \leq u < p$		
	<i>p</i> conjugate subgroups for the prime <i>p</i>		
[ <i>p</i> ] $\mathbf{b}' = p\mathbf{b}$			
C222 (21)	$\langle 3; 2 + (0, 2u, 0) \rangle$	<b>a, pb, c</b>	0, <i>u</i> , 0
	$p > 2; 0 \leq u < p$		
	<i>p</i> conjugate subgroups for the prime <i>p</i>		
[ <i>p</i> ] $\mathbf{c}' = p\mathbf{c}$			
C222 (21)	$\langle 2; 3 + (0, 0, 2u) \rangle$	<b>a, b, pc</b>	0, 0, <i>u</i>
	$p > 2; 0 \leq u < p$		
	<i>p</i> conjugate subgroups for the prime <i>p</i>		

**I Minimal translationengleiche supergroups**

[2] *Cmmm* (65); [2] *Cccm* (66); [2] *Cmme* (67); [2] *Ccce* (68); [2] *P422* (89); [2] *P4<sub>2</sub>2* (90); [2] *P4<sub>2</sub>22* (93); [2] *P4<sub>2</sub>2<sub>1</sub>2* (94);  
 [2] *P4<sub>m</sub>2* (115); [2] *P4<sub>c</sub>2* (116); [2] *P4<sub>b</sub>2* (117); [2] *P4<sub>n</sub>2* (118); [3] *P622* (177); [3] *P6<sub>2</sub>22* (180); [3] *P6<sub>4</sub>22* (181)

**II Minimal non-isomorphic klassengleiche supergroups**

- Additional centring translations

[2] *F222* (22)

- Decreased unit cell

[2]  $\mathbf{a}' = \frac{1}{2}\mathbf{a}$ ,  $\mathbf{b}' = \frac{1}{2}\mathbf{b}$  *P222* (16)

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No. 22

*F 222*

- Series of maximal isomorphic subgroups

[ $p$ ] $\mathbf{a}' = p\mathbf{a}$ <i>F222</i> (22)	$\langle (2; 3) + (2u, 0, 0) \rangle$ $p > 2; 0 \leq u < p$ $p$ conjugate subgroups for the prime $p$	$p\mathbf{a}, \mathbf{b}, \mathbf{c}$	$u, 0, 0$
[ $p$ ] $\mathbf{b}' = p\mathbf{b}$ <i>F222</i> (22)	$\langle 3; 2 + (0, 2u, 0) \rangle$ $p > 2; 0 \leq u < p$ $p$ conjugate subgroups for the prime $p$	$\mathbf{a}, p\mathbf{b}, \mathbf{c}$	$0, u, 0$
[ $p$ ] $\mathbf{c}' = p\mathbf{c}$ <i>F222</i> (22)	$\langle 2; 3 + (0, 0, 2u) \rangle$ $p > 2; 0 \leq u < p$ $p$ conjugate subgroups for the prime $p$	$\mathbf{a}, \mathbf{b}, p\mathbf{c}$	$0, 0, u$

**I Minimal translationengleiche supergroups**

[2] *Fmmm* (69); [2] *Fddd* (70); [2] *I422* (97); [2] *I4<sub>1</sub>22* (98); [2] *I4<sub>m</sub>2* (119); [2] *I4<sub>c</sub>2* (120); [3] *F23* (196)

**II Minimal non-isomorphic klassengleiche supergroups**

- Additional centring translations

none

- Decreased unit cell

[2]  $\mathbf{a}' = \frac{1}{2}\mathbf{a}$ ,  $\mathbf{b}' = \frac{1}{2}\mathbf{b}$ ,  $\mathbf{c}' = \frac{1}{2}\mathbf{c}$  *P222* (16)