

$F222$

No. 22

 $F222$
 D_2^7
Generators selected (1); $t(1,0,0)$; $t(0,1,0)$; $t(0,0,1)$; $t(0, \frac{1}{2}, \frac{1}{2})$; $t(\frac{1}{2}, 0, \frac{1}{2})$; (2); (3)

General position

 Multiplicity,
Wyckoff letter,
Site symmetry

Coordinates

 16 k 1

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

 (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] $F112$ (5, $A112$)	(1; 2)+	$1/2(\mathbf{a}-\mathbf{b}), \mathbf{b}, \mathbf{c}$
[2] $F121$ (5, $C121$)	(1; 3)+	$\mathbf{a}, \mathbf{b}, 1/2(-\mathbf{a}+\mathbf{c})$
[2] $F211$ (5, $C121$)	(1; 4)+	$\mathbf{c}, \mathbf{a}, 1/2(\mathbf{b}-\mathbf{c})$

II Maximal klassengleiche subgroups

• Loss of centring translations

[2] $A222$ (21, $C222$)	1; 2; 3; 4; (1; 2; 3; 4) + $(0, \frac{1}{2}, \frac{1}{2})$	$\mathbf{b}, \mathbf{c}, \mathbf{a}$	
[2] $A222$ (21, $C222$)	1; 4; (1; 4) + $(0, \frac{1}{2}, \frac{1}{2})$; (2; 3) + $(\frac{1}{2}, 0, \frac{1}{2})$; (2; 3) + $(\frac{1}{2}, \frac{1}{2}, 0)$	$\mathbf{b}, \mathbf{c}, \mathbf{a}$	1/4, 1/4, 1/4
[2] $B222$ (21, $C222$)	1; 2; 3; 4; (1; 2; 3; 4) + $(\frac{1}{2}, 0, \frac{1}{2})$	$\mathbf{c}, \mathbf{a}, \mathbf{b}$	
[2] $B222$ (21, $C222$)	1; 3; (1; 3) + $(\frac{1}{2}, 0, \frac{1}{2})$; (2; 4) + $(\frac{1}{2}, \frac{1}{2}, 0)$; (2; 4) + $(0, \frac{1}{2}, \frac{1}{2})$	$\mathbf{c}, \mathbf{a}, \mathbf{b}$	1/4, 1/4, 1/4
[2] $C222$ (21)	1; 2; 3; 4; (1; 2; 3; 4) + $(\frac{1}{2}, \frac{1}{2}, 0)$		
[2] $C222$ (21)	1; 2; (1; 2) + $(\frac{1}{2}, \frac{1}{2}, 0)$; (3; 4) + $(0, \frac{1}{2}, \frac{1}{2})$; (3; 4) + $(\frac{1}{2}, 0, \frac{1}{2})$		1/4, 1/4, 1/4
[2] $A2_122$ (20, $C222_1$)	1; 2; (1; 2) + $(0, \frac{1}{2}, \frac{1}{2})$; (3; 4) + $(\frac{1}{2}, 0, \frac{1}{2})$; (3; 4) + $(\frac{1}{2}, \frac{1}{2}, 0)$	$\mathbf{b}, \mathbf{c}, \mathbf{a}$	1/4, 0, 1/4
[2] $A2_122$ (20, $C222_1$)	1; 3; (1; 3) + $(0, \frac{1}{2}, \frac{1}{2})$; (2; 4) + $(\frac{1}{2}, 0, \frac{1}{2})$; (2; 4) + $(\frac{1}{2}, \frac{1}{2}, 0)$	$\mathbf{b}, \mathbf{c}, \mathbf{a}$	0, 1/4, 0
[2] $B22_12$ (20, $C222_1$)	1; 2; (1; 2) + $(\frac{1}{2}, 0, \frac{1}{2})$; (3; 4) + $(\frac{1}{2}, \frac{1}{2}, 0)$; (3; 4) + $(0, \frac{1}{2}, \frac{1}{2})$	$\mathbf{c}, \mathbf{a}, \mathbf{b}$	0, 0, 1/4
[2] $B22_12$ (20, $C222_1$)	1; 4; (1; 4) + $(\frac{1}{2}, 0, \frac{1}{2})$; (2; 3) + $(\frac{1}{2}, \frac{1}{2}, 0)$; (2; 3) + $(0, \frac{1}{2}, \frac{1}{2})$	$\mathbf{c}, \mathbf{a}, \mathbf{b}$	1/4, 1/4, 0
[2] $C222_1$ (20)	1; 3; (1; 3) + $(\frac{1}{2}, \frac{1}{2}, 0)$; (2; 4) + $(0, \frac{1}{2}, \frac{1}{2})$; (2; 4) + $(\frac{1}{2}, 0, \frac{1}{2})$		0, 1/4, 1/4
[2] $C222_1$ (20)	1; 4; (1; 4) + $(\frac{1}{2}, \frac{1}{2}, 0)$; (2; 3) + $(0, \frac{1}{2}, \frac{1}{2})$; (2; 3) + $(\frac{1}{2}, 0, \frac{1}{2})$		1/4, 0, 0

• Enlarged unit cell

[3] $\mathbf{a}' = 3\mathbf{a}$			
$\left\{ \begin{array}{l} F222 (22) \\ F222 (22) \\ F222 (22) \end{array} \right.$	$\langle 2; 3 \rangle$ $\langle (2; 3) + (2, 0, 0) \rangle$ $\langle (2; 3) + (4, 0, 0) \rangle$	$3\mathbf{a}, \mathbf{b}, \mathbf{c}$ $3\mathbf{a}, \mathbf{b}, \mathbf{c}$ $3\mathbf{a}, \mathbf{b}, \mathbf{c}$	1, 0, 0 2, 0, 0
[3] $\mathbf{b}' = 3\mathbf{b}$			
$\left\{ \begin{array}{l} F222 (22) \\ F222 (22) \\ F222 (22) \end{array} \right.$	$\langle 2; 3 \rangle$ $\langle 3; 2 + (0, 2, 0) \rangle$ $\langle 3; 2 + (0, 4, 0) \rangle$	$\mathbf{a}, 3\mathbf{b}, \mathbf{c}$ $\mathbf{a}, 3\mathbf{b}, \mathbf{c}$ $\mathbf{a}, 3\mathbf{b}, \mathbf{c}$	0, 1, 0 0, 2, 0
[3] $\mathbf{c}' = 3\mathbf{c}$			
$\left\{ \begin{array}{l} F222 (22) \\ F222 (22) \\ F222 (22) \end{array} \right.$	$\langle 2; 3 \rangle$ $\langle 2; 3 + (0, 0, 2) \rangle$ $\langle 2; 3 + (0, 0, 4) \rangle$	$\mathbf{a}, \mathbf{b}, 3\mathbf{c}$ $\mathbf{a}, \mathbf{b}, 3\mathbf{c}$ $\mathbf{a}, \mathbf{b}, 3\mathbf{c}$	0, 0, 1 0, 0, 2

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I Minimal translationengleiche supergroups

[2] $Cmmm$ (65); [2] $Cccm$ (66); [2] $Cmme$ (67); [2] $Ccce$ (68); [2] $P422$ (89); [2] $P4_22$ (90); [2] $P4_222$ (93); [2] $P4_22_12$ (94); [2] $P\bar{4}m2$ (115); [2] $P\bar{4}c2$ (116); [2] $P\bar{4}b2$ (117); [2] $P\bar{4}n2$ (118); [3] $P622$ (177); [3] $P6_222$ (180); [3] $P6_422$ (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

F222

- Series of maximal isomorphic subgroups

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

I Minimal translationengleiche supergroups

[2] $Fmmm$ (69); [2] $Fddd$ (70); [2] $I422$ (97); [2] $I4_122$ (98); [2] $I\bar{4}m2$ (119); [2] $I\bar{4}c2$ (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)