

$P4_2/n\,cm$

No. 138

 $P4_2/n\,2_1/c\,2/m$
 D_{4h}^{16}

 ORIGIN CHOICE 1, Origin at $\bar{4}c\,g$, at $-\frac{1}{4}, \frac{1}{4}, -\frac{1}{4}$ from centre ($2/m$)

 Generators selected (1); $t(1,0,0)$; $t(0,1,0)$; $t(0,0,1)$; (2); (3); (5); (9)

General position

 Multiplicity,
Wyckoff letter,
Site symmetry

Coordinates

16	j	1	(1) x, y, z	(2) \bar{x}, \bar{y}, z	(3) $\bar{y} + \frac{1}{2}, x + \frac{1}{2}, z + \frac{1}{2}$	(4) $y + \frac{1}{2}, \bar{x} + \frac{1}{2}, z + \frac{1}{2}$
			(5) $\bar{x} + \frac{1}{2}, y + \frac{1}{2}, \bar{z}$	(6) $x + \frac{1}{2}, \bar{y} + \frac{1}{2}, \bar{z}$	(7) $y, x, \bar{z} + \frac{1}{2}$	(8) $\bar{y}, \bar{x}, \bar{z} + \frac{1}{2}$
			(9) $\bar{x} + \frac{1}{2}, \bar{y} + \frac{1}{2}, \bar{z} + \frac{1}{2}$	(10) $x + \frac{1}{2}, y + \frac{1}{2}, \bar{z} + \frac{1}{2}$	(11) y, \bar{x}, \bar{z}	(12) \bar{y}, x, \bar{z}
			(13) $x, \bar{y}, z + \frac{1}{2}$	(14) $\bar{x}, y, z + \frac{1}{2}$	(15) $\bar{y} + \frac{1}{2}, \bar{x} + \frac{1}{2}, z$	(16) $y + \frac{1}{2}, x + \frac{1}{2}, z$

I Maximal translationengleiche subgroups

[2] $P\bar{4}c2$ (116)	1; 2; 7; 8; 11; 12; 13; 14		
[2] $P\bar{4}2_1m$ (113)	1; 2; 5; 6; 11; 12; 15; 16		
[2] $P4_2cm$ (101)	1; 2; 3; 4; 13; 14; 15; 16		0, 1/2, 0
[2] $P4_22_12$ (94)	1; 2; 3; 4; 5; 6; 7; 8		0, 0, 1/4
[2] $P4_2/n11$ (86, $P4_2/n$)	1; 2; 3; 4; 9; 10; 11; 12		
[2] $P2/n12/m$ (67, $Cmme$)	1; 2; 7; 8; 9; 10; 15; 16	$\mathbf{a} - \mathbf{b}, \mathbf{a} + \mathbf{b}, \mathbf{c}$	1/4, 3/4, 1/4
[2] $P2/n2_1/c1$ (56, $Pccn$)	1; 2; 5; 6; 9; 10; 13; 14		1/4, 1/4, 1/4

II Maximal klassengleiche subgroups

• Enlarged unit cell

[3] $\mathbf{c}' = 3\mathbf{c}$			
$\left\{ \begin{array}{l} P4_2/n\,cm \text{ (138)} \\ P4_2/n\,cm \text{ (138)} \\ P4_2/n\,cm \text{ (138)} \end{array} \right.$	$\langle 2; 5; (3; 9) + (0, 0, 1) \rangle$	$\mathbf{a}, \mathbf{b}, 3\mathbf{c}$	
	$\langle 2; 3 + (0, 0, 1); 5 + (0, 0, 2); 9 + (0, 0, 3) \rangle$	$\mathbf{a}, \mathbf{b}, 3\mathbf{c}$	0, 0, 1
	$\langle 2; 3 + (0, 0, 1); 5 + (0, 0, 4); 9 + (0, 0, 5) \rangle$	$\mathbf{a}, \mathbf{b}, 3\mathbf{c}$	0, 0, 2

• Series of maximal isomorphic subgroups

[p] $\mathbf{c}' = p\mathbf{c}$			
$P4_2/n\,cm$ (138)	$\langle 2; 3 + (0, 0, \frac{p}{2} - \frac{1}{2}); 5 + (0, 0, 2u); 9 + (0, 0, \frac{p}{2} - \frac{1}{2} + 2u) \rangle$ prime $p > 2$; $0 \leq u < p$ p conjugate subgroups	$\mathbf{a}, \mathbf{b}, p\mathbf{c}$	0, 0, u
[p^2] $\mathbf{a}' = p\mathbf{a}, \mathbf{b}' = p\mathbf{b}$			
$P4_2/n\,cm$ (138)	$\langle 2 + (2u, 2v, 0); 3 + (\frac{p}{2} - \frac{1}{2} + u + v, \frac{p}{2} - \frac{1}{2} - u + v, 0); 5 + (\frac{p}{2} - \frac{1}{2} + 2u, \frac{p}{2} - \frac{1}{2}, 0); 9 + (\frac{p}{2} - \frac{1}{2} + 2u, \frac{p}{2} - \frac{1}{2} + 2v, 0) \rangle$ prime $p > 2$; $0 \leq u < p$; $0 \leq v < p$ p^2 conjugate subgroups	$p\mathbf{a}, p\mathbf{b}, \mathbf{c}$	$u, v, 0$

I Minimal translationengleiche supergroups

none

II Minimal non-isomorphic klassengleiche supergroups

• Additional centring translations

 [2] $C4_2/m\,cm$ (131, $P4_2/m\,m\,c$); [2] $I4/m\,cm$ (140)

• Decreased unit cell

 [2] $\mathbf{c}' = \frac{1}{2}\mathbf{c}$ $P4/n\,mm$ (129)

ORIGIN CHOICE 2, Origin at centre ($2/m$) at $n1(2/m, 2_1/g)$, at $\frac{1}{4}, -\frac{1}{4}, \frac{1}{4}$ from $\bar{4}$

Generators selected (1); $t(1,0,0)$; $t(0,1,0)$; $t(0,0,1)$; (2); (3); (5); (9)

General position

Multiplicity,
Wyckoff letter,
Site symmetry

Coordinates

16	j	1	(1) x, y, z	(2) $\bar{x} + \frac{1}{2}, \bar{y} + \frac{1}{2}, z$	(3) $\bar{y} + \frac{1}{2}, x, z + \frac{1}{2}$	(4) $y, \bar{x} + \frac{1}{2}, z + \frac{1}{2}$
			(5) $\bar{x}, y + \frac{1}{2}, \bar{z} + \frac{1}{2}$	(6) $x + \frac{1}{2}, \bar{y}, \bar{z} + \frac{1}{2}$	(7) $y + \frac{1}{2}, x + \frac{1}{2}, \bar{z}$	(8) $\bar{y}, \bar{x}, \bar{z}$
			(9) $\bar{x}, \bar{y}, \bar{z}$	(10) $x + \frac{1}{2}, y + \frac{1}{2}, \bar{z}$	(11) $y + \frac{1}{2}, \bar{x}, \bar{z} + \frac{1}{2}$	(12) $\bar{y}, x + \frac{1}{2}, \bar{z} + \frac{1}{2}$
			(13) $x, \bar{y} + \frac{1}{2}, z + \frac{1}{2}$	(14) $\bar{x} + \frac{1}{2}, y, z + \frac{1}{2}$	(15) $\bar{y} + \frac{1}{2}, \bar{x} + \frac{1}{2}, z$	(16) y, x, z

I Maximal translationengleiche subgroups

[2] $P\bar{4}c2$ (116)	1; 2; 7; 8; 11; 12; 13; 14		1/4, 3/4, 1/4
[2] $P\bar{4}2_1m$ (113)	1; 2; 5; 6; 11; 12; 15; 16		1/4, 3/4, 1/4
[2] $P4_2cm$ (101)	1; 2; 3; 4; 13; 14; 15; 16		1/4, 1/4, 0
[2] $P4_22_12$ (94)	1; 2; 3; 4; 5; 6; 7; 8		1/4, 3/4, 0
[2] $P4_2/n11$ (86, $P4_2/n$)	1; 2; 3; 4; 9; 10; 11; 12		0, 1/2, 0
[2] $P2/n12/m$ (67, $Cmme$)	1; 2; 7; 8; 9; 10; 15; 16	a - b, a + b, c	
[2] $P2/n2_1/c1$ (56, $Pccn$)	1; 2; 5; 6; 9; 10; 13; 14		

II Maximal klassengleiche subgroups

• Enlarged unit cell

[3] $\mathbf{c}' = 3\mathbf{c}$			
$\left\{ \begin{array}{l} P4_2/n\bar{c}m \text{ (138)} \\ P4_2/n\bar{c}m \text{ (138)} \\ P4_2/n\bar{c}m \text{ (138)} \end{array} \right.$	$\langle 2; 9; (3; 5) + (0, 0, 1) \rangle$	a, b, 3c	
	$\langle 2; 3 + (0, 0, 1); 5 + (0, 0, 3); 9 + (0, 0, 2) \rangle$	a, b, 3c	0, 0, 1
	$\langle 2; 3 + (0, 0, 1); 5 + (0, 0, 5); 9 + (0, 0, 4) \rangle$	a, b, 3c	0, 0, 2

• Series of maximal isomorphic subgroups

[p] $\mathbf{c}' = p\mathbf{c}$			
$P4_2/n\bar{c}m$ (138)	$\langle 2; 3 + (0, 0, \frac{p}{2} - \frac{1}{2}); 5 + (0, 0, \frac{p}{2} - \frac{1}{2} + 2u); 9 + (0, 0, 2u) \rangle$	a, b, pc	0, 0, u
	prime $p > 2$; $0 \leq u < p$		
	p conjugate subgroups		
[p^2] $\mathbf{a}' = p\mathbf{a}, \mathbf{b}' = p\mathbf{b}$			
$P4_2/n\bar{c}m$ (138)	$\langle 2 + (\frac{p}{2} - \frac{1}{2} + 2u, \frac{p}{2} - \frac{1}{2} + 2v, 0); 3 + (\frac{p}{2} - \frac{1}{2} + u + v, -u + v, 0); 5 + (2u, \frac{p}{2} - \frac{1}{2}, 0); 9 + (2u, 2v, 0) \rangle$	pa, pb, c	$u, v, 0$
	prime $p > 2$; $0 \leq u < p$; $0 \leq v < p$		
	p^2 conjugate subgroups		

I Minimal translationengleiche supergroups

none

II Minimal non-isomorphic klassengleiche supergroups

• Additional centring translations

[2] $C4_2/m\bar{c}m$ (131, $P4_2/m\bar{m}c$); [2] $I4/m\bar{c}m$ (140)

• Decreased unit cell

[2] $\mathbf{c}' = \frac{1}{2}\mathbf{c}$ $P4/n\bar{m}m$ (129)