

$P4_2/nbc$

No. 133

 $P4_2/n2/b2/c$
 D_{4h}^{11}

 ORIGIN CHOICE 1, Origin at $\bar{4}12_1/c$, at $-\frac{1}{4}, \frac{1}{4}, -\frac{1}{4}$ from $\bar{1}$

 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	k	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) $\bar{x}, y, \bar{z} + \frac{1}{2}$	(6) $x, \bar{y}, \bar{z} + \frac{1}{2}$	(7) $y + \frac{1}{2}, x + \frac{1}{2}, \bar{z}$	(8) $\bar{y} + \frac{1}{2}, \bar{x} + \frac{1}{2}, \bar{z}$
			(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) $x + \frac{1}{2}, \bar{y} + \frac{1}{2}, z$	(14) $\bar{x} + \frac{1}{2}, y + \frac{1}{2}, z$	(15) $\bar{y}, \bar{x}, z + \frac{1}{2}$	(16) $y, x, z + \frac{1}{2}$

I Maximal translationengleiche subgroups

[2] $P\bar{4}b2$ (117)	1; 2; 7; 8; 11; 12; 13; 14		
[2] $P\bar{4}2c$ (112)	1; 2; 5; 6; 11; 12; 15; 16		
[2] $P4_2bc$ (106)	1; 2; 3; 4; 13; 14; 15; 16		0, 1/2, 0
[2] $P4_222$ (93)	1; 2; 3; 4; 5; 6; 7; 8		0, 1/2, 1/4
[2] $P4_2/n11$ (86, $P4_2/n$)	1; 2; 3; 4; 9; 10; 11; 12		
[2] $P2/n12/c$ (68, $Ccce$)	1; 2; 7; 8; 9; 10; 15; 16	$\mathbf{a - b, a + b, c}$	1/2, 0, 0
[2] $P2/n2/b1$ (50, $Pban$)	1; 2; 5; 6; 9; 10; 13; 14		0, 0, 1/4

II Maximal klassengleiche subgroups

• Enlarged unit cell

[3] $\mathbf{c}' = 3\mathbf{c}$			
$\left\{ \begin{array}{l} P4_2/nbc \text{ (133)} \\ P4_2/nbc \text{ (133)} \\ P4_2/nbc \text{ (133)} \end{array} \right.$	$\langle 2; (3; 5; 9) + (0, 0, 1) \rangle$	$\mathbf{a, b, 3c}$	
	$\langle 2; 3 + (0, 0, 1); (5; 9) + (0, 0, 3) \rangle$	$\mathbf{a, b, 3c}$	0, 0, 1
	$\langle 2; 3 + (0, 0, 1); (5; 9) + (0, 0, 5) \rangle$	$\mathbf{a, b, 3c}$	0, 0, 2

• Series of maximal isomorphic subgroups

[p] $\mathbf{c}' = p\mathbf{c}$			
$P4_2/nbc$ (133)	$\langle 2; 3 + (0, 0, \frac{p}{2} - \frac{1}{2}); (5; 9) + (0, 0, \frac{p}{2} - \frac{1}{2} + 2u) \rangle$ prime $p > 2$; $0 \leq u < p$ p conjugate subgroups	$\mathbf{a, b, pc}$	0, 0, u
[p^2] $\mathbf{a}' = p\mathbf{a}, \mathbf{b}' = p\mathbf{b}$			
$P4_2/nbc$ (133)	$\langle 2 + (2u, 2v, 0); 3 + (\frac{p}{2} - \frac{1}{2} + u + v, \frac{p}{2} - \frac{1}{2} - u + v, 0); 5 + (2u, 0, 0); 9 + (\frac{p}{2} - \frac{1}{2} + 2u, \frac{p}{2} - \frac{1}{2} + 2v, 0) \rangle$ prime $p > 2$; $0 \leq u < p$; $0 \leq v < p$ p^2 conjugate subgroups	$\mathbf{pa, pb, c}$	$u, v, 0$

I Minimal translationengleiche supergroups

none

II Minimal non-isomorphic klassengleiche supergroups

• Additional centring translations

 [2] $C4_2/mmc$ (132, $P4_2/mcm$); [2] $I4/mcm$ (140)

• Decreased unit cell

 [2] $\mathbf{c}' = \frac{1}{2}\mathbf{c}$ $P4/nbm$ (125)

ORIGIN CHOICE 2, Origin at $\bar{1}$ at $n(b,a)(n,c)$, 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	k	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) $\bar{x} + \frac{1}{2}, y, \bar{z}$	(6) $x, \bar{y} + \frac{1}{2}, \bar{z}$	(7) $y, x, \bar{z} + \frac{1}{2}$	(8) $\bar{y} + \frac{1}{2}, \bar{x} + \frac{1}{2}, \bar{z} + \frac{1}{2}$
			(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) $x + \frac{1}{2}, \bar{y}, z$	(14) $\bar{x}, y + \frac{1}{2}, z$	(15) $\bar{y}, \bar{x}, z + \frac{1}{2}$	(16) $y + \frac{1}{2}, x + \frac{1}{2}, z + \frac{1}{2}$

I Maximal translationengleiche subgroups

[2] $P4b2$ (117)	1; 2; 7; 8; 11; 12; 13; 14		$1/4, 3/4, 1/4$
[2] $P4_2c$ (112)	1; 2; 5; 6; 11; 12; 15; 16		$1/4, 3/4, 1/4$
[2] $P4_2bc$ (106)	1; 2; 3; 4; 13; 14; 15; 16		$1/4, 1/4, 0$
[2] $P4_222$ (93)	1; 2; 3; 4; 5; 6; 7; 8		$1/4, 1/4, 0$
[2] $P4_2/n11$ (86, $P4_2/n$)	1; 2; 3; 4; 9; 10; 11; 12		$0, 1/2, 0$
[2] $P2/n12/c$ (68, $Ccce$)	1; 2; 7; 8; 9; 10; 15; 16	a - b, a + b, c	
[2] $P2/n2/b1$ (50, $Pban$)	1; 2; 5; 6; 9; 10; 13; 14		

II Maximal klassengleiche subgroups

• Enlarged unit cell

[3] $c' = 3c$			
$\left\{ \begin{array}{l} P4_2/nbc \text{ (133)} \\ P4_2/nbc \text{ (133)} \\ P4_2/nbc \text{ (133)} \end{array} \right.$	$\langle 2; 5; 9; 3 + (0,0,1) \rangle$	a, b, 3c	
	$\langle 2; 3 + (0,0,1); (5; 9) + (0,0,2) \rangle$	a, b, 3c	$0, 0, 1$
	$\langle 2; 3 + (0,0,1); (5; 9) + (0,0,4) \rangle$	a, b, 3c	$0, 0, 2$

• Series of maximal isomorphic subgroups

[p] $c' = pc$			
$P4_2/nbc$ (133)	$\langle 2; 3 + (0,0, \frac{p}{2} - \frac{1}{2}); (5; 9) + (0,0, 2u) \rangle$	a, b, pc	$0, 0, u$
	prime $p > 2$; $0 \leq u < p$		
	p conjugate subgroups		
[p ²] $a' = pa, b' = pb$			
$P4_2/nbc$ (133)	$\langle 2 + (\frac{p}{2} - \frac{1}{2} + 2u, \frac{p}{2} - \frac{1}{2} + 2v, 0);$	pa, pb, c	$u, v, 0$
	$3 + (\frac{p}{2} - \frac{1}{2} + u + v, -u + v, 0); 5 + (\frac{p}{2} - \frac{1}{2} + 2u, 0, 0);$		
	$9 + (2u, 2v, 0) \rangle$		
	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] $C4_2/mmc$ (132, $P4_2/mcm$); [2] $I4/mcm$ (140)

• Decreased unit cell

[2] $c' = \frac{1}{2}c$ $P4/nbm$ (125)