

P312

No. 149

P312

D_3^1

Generators selected (1); $t(1,0,0)$; $t(0,1,0)$; $t(0,0,1)$; (2); (4)

General position

 Multiplicity,
Wyckoff letter,
Site symmetry

Coordinates

 6 *l* 1

 (1) x, y, z (2) $\bar{y}, x-y, z$ (3) $\bar{x}+y, \bar{x}, z$
 (4) $\bar{y}, \bar{x}, \bar{z}$ (5) $\bar{x}+y, y, \bar{z}$ (6) $x, x-y, \bar{z}$
I Maximal translationengleiche subgroups

[2] P311 (143, P3)	1; 2; 3	
{ [3] P112 (5, C121)	1; 4	$-\mathbf{a} - \mathbf{b}, \mathbf{a} - \mathbf{b}, \mathbf{c}$
[3] P112 (5, C121)	1; 5	$\mathbf{a}, \mathbf{a} + 2\mathbf{b}, \mathbf{c}$
{ [3] P112 (5, C121)	1; 6	$\mathbf{b}, -2\mathbf{a} - \mathbf{b}, \mathbf{c}$

II Maximal klassengleiche subgroups
• Enlarged unit cell

[2] $\mathbf{c}' = 2\mathbf{c}$			
P312 (149)	$\langle 2; 4 \rangle$	$\mathbf{a}, \mathbf{b}, 2\mathbf{c}$	
P312 (149)	$\langle 2; 4 + (0, 0, 1) \rangle$	$\mathbf{a}, \mathbf{b}, 2\mathbf{c}$	0, 0, 1/2
[3] $\mathbf{c}' = 3\mathbf{c}$			
{ P3 ₂ 12 (153)	$\langle 2 + (0, 0, 2); 4 + (0, 0, 1) \rangle$	$\mathbf{a}, \mathbf{b}, 3\mathbf{c}$	
{ P3 ₂ 12 (153)	$\langle 2 + (0, 0, 2); 4 + (0, 0, 3) \rangle$	$\mathbf{a}, \mathbf{b}, 3\mathbf{c}$	0, 0, 1
{ P3 ₂ 12 (153)	$\langle 2 + (0, 0, 2); 4 + (0, 0, 5) \rangle$	$\mathbf{a}, \mathbf{b}, 3\mathbf{c}$	0, 0, 2
{ P3 ₁ 12 (151)	$\langle 2 + (0, 0, 1); 4 + (0, 0, 2) \rangle$	$\mathbf{a}, \mathbf{b}, 3\mathbf{c}$	
{ P3 ₁ 12 (151)	$\langle 2 + (0, 0, 1); 4 + (0, 0, 4) \rangle$	$\mathbf{a}, \mathbf{b}, 3\mathbf{c}$	0, 0, 1
{ P3 ₁ 12 (151)	$\langle 2 + (0, 0, 1); 4 + (0, 0, 6) \rangle$	$\mathbf{a}, \mathbf{b}, 3\mathbf{c}$	0, 0, 2
{ P312 (149)	$\langle 2; 4 \rangle$	$\mathbf{a}, \mathbf{b}, 3\mathbf{c}$	
{ P312 (149)	$\langle 2; 4 + (0, 0, 2) \rangle$	$\mathbf{a}, \mathbf{b}, 3\mathbf{c}$	0, 0, 1
{ P312 (149)	$\langle 2; 4 + (0, 0, 4) \rangle$	$\mathbf{a}, \mathbf{b}, 3\mathbf{c}$	0, 0, 2
[3] $\mathbf{a}' = 3\mathbf{a}, \mathbf{b}' = 3\mathbf{b}$			
{ H312 (150, P321)	$\langle 2; 4 \rangle$	$\mathbf{a} - \mathbf{b}, \mathbf{a} + 2\mathbf{b}, \mathbf{c}$	
{ H312 (150, P321)	$\langle 2 + (1, -1, 0); 4 + (1, 1, 0) \rangle$	$\mathbf{a} - \mathbf{b}, \mathbf{a} + 2\mathbf{b}, \mathbf{c}$	1, 0, 0
{ H312 (150, P321)	$\langle 2 + (2, 1, 0); 4 + (2, 2, 0) \rangle$	$\mathbf{a} - \mathbf{b}, \mathbf{a} + 2\mathbf{b}, \mathbf{c}$	1, 1, 0
{ H312 (150, P321)	$\langle 2 + (1, 0, 0); 4 + (1, 1, 0) \rangle$	$\mathbf{a} - \mathbf{b}, \mathbf{a} + 2\mathbf{b}, \mathbf{c}$	2/3, 1/3, 0
{ H312 (150, P321)	$\langle (2; 4) + (2, 2, 0) \rangle$	$\mathbf{a} - \mathbf{b}, \mathbf{a} + 2\mathbf{b}, \mathbf{c}$	2/3, 4/3, 0
{ H312 (150, P321)	$\langle 2 + (3, 4, 0); 4 + (3, 3, 0) \rangle$	$\mathbf{a} - \mathbf{b}, \mathbf{a} + 2\mathbf{b}, \mathbf{c}$	2/3, 7/3, 0
{ H312 (150, P321)	$\langle (2; 4) + (1, 1, 0) \rangle$	$\mathbf{a} - \mathbf{b}, \mathbf{a} + 2\mathbf{b}, \mathbf{c}$	1/3, 2/3, 0
{ H312 (150, P321)	$\langle 2 + (2, 0, 0); 4 + (2, 2, 0) \rangle$	$\mathbf{a} - \mathbf{b}, \mathbf{a} + 2\mathbf{b}, \mathbf{c}$	4/3, 2/3, 0
{ H312 (150, P321)	$\langle 2 + (3, -1, 0); 4 + (3, 3, 0) \rangle$	$\mathbf{a} - \mathbf{b}, \mathbf{a} + 2\mathbf{b}, \mathbf{c}$	7/3, 2/3, 0
[3] $\mathbf{a}' = \mathbf{a} - \mathbf{b}, \mathbf{b}' = \mathbf{a} + 2\mathbf{b}, \mathbf{c}' = 3\mathbf{c}$			
{ R32 (155)	$\langle 2; 4 \rangle$	$\mathbf{a} - \mathbf{b}, \mathbf{a} + 2\mathbf{b}, 3\mathbf{c}$	
{ R32 (155)	$\langle 2; 4 + (0, 0, 2) \rangle$	$\mathbf{a} - \mathbf{b}, \mathbf{a} + 2\mathbf{b}, 3\mathbf{c}$	0, 0, 1
{ R32 (155)	$\langle 2; 4 + (0, 0, 4) \rangle$	$\mathbf{a} - \mathbf{b}, \mathbf{a} + 2\mathbf{b}, 3\mathbf{c}$	0, 0, 2
{ R32 (155)	$\langle 2 + (1, 0, 0); 4 + (1, 1, 0) \rangle$	$\mathbf{a} - \mathbf{b}, \mathbf{a} + 2\mathbf{b}, 3\mathbf{c}$	2/3, 1/3, 0
{ R32 (155)	$\langle 2 + (1, 0, 0); 4 + (1, 1, 2) \rangle$	$\mathbf{a} - \mathbf{b}, \mathbf{a} + 2\mathbf{b}, 3\mathbf{c}$	2/3, 1/3, 1
{ R32 (155)	$\langle 2 + (1, 0, 0); 4 + (1, 1, 4) \rangle$	$\mathbf{a} - \mathbf{b}, \mathbf{a} + 2\mathbf{b}, 3\mathbf{c}$	2/3, 1/3, 2
{ R32 (155)	$\langle (2; 4) + (1, 1, 0) \rangle$	$\mathbf{a} - \mathbf{b}, \mathbf{a} + 2\mathbf{b}, 3\mathbf{c}$	1/3, 2/3, 0
{ R32 (155)	$\langle 2 + (1, 1, 0); 4 + (1, 1, 2) \rangle$	$\mathbf{a} - \mathbf{b}, \mathbf{a} + 2\mathbf{b}, 3\mathbf{c}$	1/3, 2/3, 1
{ R32 (155)	$\langle 2 + (1, 1, 0); 4 + (1, 1, 4) \rangle$	$\mathbf{a} - \mathbf{b}, \mathbf{a} + 2\mathbf{b}, 3\mathbf{c}$	1/3, 2/3, 2
[3] $\mathbf{a}' = 2\mathbf{a} + \mathbf{b}, \mathbf{b}' = -\mathbf{a} + \mathbf{b}, \mathbf{c}' = 3\mathbf{c}$			
{ R32 (155)	$\langle 2; 4 \rangle$	$2\mathbf{a} + \mathbf{b}, -\mathbf{a} + \mathbf{b}, 3\mathbf{c}$	
{ R32 (155)	$\langle 2; 4 + (0, 0, 2) \rangle$	$2\mathbf{a} + \mathbf{b}, -\mathbf{a} + \mathbf{b}, 3\mathbf{c}$	0, 0, 1
{ R32 (155)	$\langle 2; 4 + (0, 0, 4) \rangle$	$2\mathbf{a} + \mathbf{b}, -\mathbf{a} + \mathbf{b}, 3\mathbf{c}$	0, 0, 2
{ R32 (155)	$\langle 2 + (1, 0, 0); 4 + (1, 1, 0) \rangle$	$2\mathbf{a} + \mathbf{b}, -\mathbf{a} + \mathbf{b}, 3\mathbf{c}$	2/3, 1/3, 0
{ R32 (155)	$\langle 2 + (1, 0, 0); 4 + (1, 1, 2) \rangle$	$2\mathbf{a} + \mathbf{b}, -\mathbf{a} + \mathbf{b}, 3\mathbf{c}$	2/3, 1/3, 1
{ R32 (155)	$\langle 2 + (1, 0, 0); 4 + (1, 1, 4) \rangle$	$2\mathbf{a} + \mathbf{b}, -\mathbf{a} + \mathbf{b}, 3\mathbf{c}$	2/3, 1/3, 2
{ R32 (155)	$\langle (2; 4) + (1, 1, 0) \rangle$	$2\mathbf{a} + \mathbf{b}, -\mathbf{a} + \mathbf{b}, 3\mathbf{c}$	1/3, 2/3, 0
{ R32 (155)	$\langle 2 + (1, 1, 0); 4 + (1, 1, 2) \rangle$	$2\mathbf{a} + \mathbf{b}, -\mathbf{a} + \mathbf{b}, 3\mathbf{c}$	1/3, 2/3, 1
{ R32 (155)	$\langle 2 + (1, 1, 0); 4 + (1, 1, 4) \rangle$	$2\mathbf{a} + \mathbf{b}, -\mathbf{a} + \mathbf{b}, 3\mathbf{c}$	1/3, 2/3, 2
[4] $\mathbf{a}' = 2\mathbf{a}, \mathbf{b}' = 2\mathbf{b}$			
{ P312 (149)	$\langle 2; 4 \rangle$	$2\mathbf{a}, 2\mathbf{b}, \mathbf{c}$	
{ P312 (149)	$\langle 2 + (1, -1, 0); 4 + (1, 1, 0) \rangle$	$2\mathbf{a}, 2\mathbf{b}, \mathbf{c}$	1, 0, 0
{ P312 (149)	$\langle 2 + (1, 2, 0); 4 + (1, 1, 0) \rangle$	$2\mathbf{a}, 2\mathbf{b}, \mathbf{c}$	0, 1, 0
{ P312 (149)	$\langle 2 + (2, 1, 0); 4 + (2, 2, 0) \rangle$	$2\mathbf{a}, 2\mathbf{b}, \mathbf{c}$	1, 1, 0

- **Series of maximal isomorphic subgroups**

$[p] \mathbf{c}' = p\mathbf{c}$ P312 (149)	$\langle 2; 4 + (0, 0, 2u) \rangle$ $p > 2; 0 \leq u < p$ p conjugate subgroups for the prime p	$\mathbf{a}, \mathbf{b}, p\mathbf{c}$	$0, 0, u$
$[p^2] \mathbf{a}' = p\mathbf{a}, \mathbf{b}' = p\mathbf{b}$ P312 (149)	$\langle 2 + (u + v, -u + 2v, 0); 4 + (u + v, u + v, 0) \rangle$ $p > 1; p \neq 3; 0 \leq u < p; 0 \leq v < p$ p^2 conjugate subgroups for the prime p	$p\mathbf{a}, p\mathbf{b}, \mathbf{c}$	$u, v, 0$

I Minimal translationengleiche supergroups

[2] $P\bar{3}1m$ (162); [2] $P\bar{3}1c$ (163); [2] $P622$ (177); [2] $P6_322$ (182); [2] $P\bar{6}m2$ (187); [2] $P\bar{6}c2$ (188)

II Minimal non-isomorphic klassengleiche supergroups

- **Additional centring translations**

[3] $H312$ (150, $P321$)

- **Decreased unit cell**

none