

$P422$

D_4^1

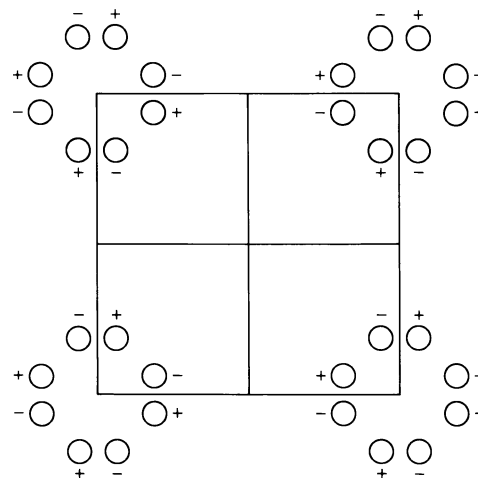
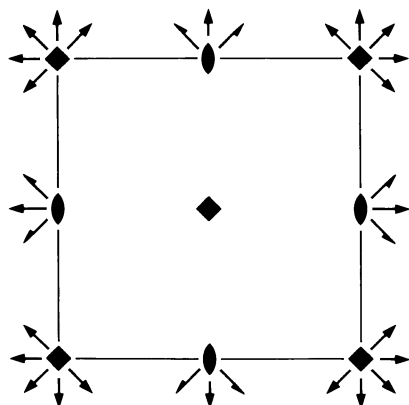
422

Tetragonal

No. 89

$P422$

Patterson symmetry $P4/mmm$



Origin at 422

Asymmetric unit $0 \leq x \leq \frac{1}{2}; 0 \leq y \leq \frac{1}{2}; 0 \leq z \leq \frac{1}{2}$

Symmetry operations

- | | | | |
|---------------|---------------|-------------------|---------------------|
| (1) 1 | (2) 2 $0,0,z$ | (3) 4^+ $0,0,z$ | (4) 4^- $0,0,z$ |
| (5) 2 $0,y,0$ | (6) 2 $x,0,0$ | (7) 2 $x,x,0$ | (8) 2 $x,\bar{x},0$ |

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

Positions

Multiplicity, Wyckoff letter, Site symmetry	Coordinates				Reflection conditions
					General:
8 <i>p</i> 1	(1) x, y, z (5) \bar{x}, y, \bar{z}	(2) \bar{x}, \bar{y}, z (6) x, \bar{y}, \bar{z}	(3) \bar{y}, x, z (7) y, x, \bar{z}	(4) y, \bar{x}, z (8) $\bar{y}, \bar{x}, \bar{z}$	no conditions
					Special:
4 <i>o</i> .2.	$x, \frac{1}{2}, 0$	$\bar{x}, \frac{1}{2}, 0$	$\frac{1}{2}, x, 0$	$\frac{1}{2}, \bar{x}, 0$	no extra conditions
4 <i>n</i> .2.	$x, 0, \frac{1}{2}$	$\bar{x}, 0, \frac{1}{2}$	$0, x, \frac{1}{2}$	$0, \bar{x}, \frac{1}{2}$	no extra conditions
4 <i>m</i> .2.	$x, \frac{1}{2}, \frac{1}{2}$	$\bar{x}, \frac{1}{2}, \frac{1}{2}$	$\frac{1}{2}, x, \frac{1}{2}$	$\frac{1}{2}, \bar{x}, \frac{1}{2}$	no extra conditions
4 <i>l</i> .2.	$x, 0, 0$	$\bar{x}, 0, 0$	$0, x, 0$	$0, \bar{x}, 0$	no extra conditions
4 <i>k</i> ..2	$x, x, \frac{1}{2}$	$\bar{x}, \bar{x}, \frac{1}{2}$	$\bar{x}, x, \frac{1}{2}$	$x, \bar{x}, \frac{1}{2}$	no extra conditions
4 <i>j</i> ..2	$x, x, 0$	$\bar{x}, \bar{x}, 0$	$\bar{x}, x, 0$	$x, \bar{x}, 0$	no extra conditions
4 <i>i</i> 2..	$0, \frac{1}{2}, z$	$\frac{1}{2}, 0, z$	$0, \frac{1}{2}, \bar{z}$	$\frac{1}{2}, 0, \bar{z}$	$hkl : h + k = 2n$
2 <i>h</i> 4..	$\frac{1}{2}, \frac{1}{2}, z$	$\frac{1}{2}, \frac{1}{2}, \bar{z}$			no extra conditions
2 <i>g</i> 4..	$0, 0, z$	$0, 0, \bar{z}$			no extra conditions
2 <i>f</i> 222.	$\frac{1}{2}, 0, \frac{1}{2}$	$0, \frac{1}{2}, \frac{1}{2}$			$hkl : h + k = 2n$
2 <i>e</i> 222.	$\frac{1}{2}, 0, 0$	$0, \frac{1}{2}, 0$			$hkl : h + k = 2n$
1 <i>d</i> 422	$\frac{1}{2}, \frac{1}{2}, \frac{1}{2}$				no extra conditions
1 <i>c</i> 422	$\frac{1}{2}, \frac{1}{2}, 0$				no extra conditions
1 <i>b</i> 422	$0, 0, \frac{1}{2}$				no extra conditions
1 <i>a</i> 422	$0, 0, 0$				no extra conditions

Symmetry of special projections

Along [001] $p4mm$

$\mathbf{a}' = \mathbf{a}$ $\mathbf{b}' = \mathbf{b}$

Origin at $0, 0, z$

Along [100] $p2mm$

$\mathbf{a}' = \mathbf{b}$ $\mathbf{b}' = \mathbf{c}$

Origin at $x, 0, 0$

Along [110] $p2mm$

$\mathbf{a}' = \frac{1}{2}(-\mathbf{a} + \mathbf{b})$ $\mathbf{b}' = \mathbf{c}$

Origin at $x, x, 0$

Maximal non-isomorphic subgroups

I [2] $P411$ ($P4, 75$) 1; 2; 3; 4
 [2] $P212$ ($C222, 21$) 1; 2; 7; 8
 [2] $P221$ ($P222, 16$) 1; 2; 5; 6

IIa none

IIb [2] $P4_222$ ($\mathbf{c}' = 2\mathbf{c}$) (93); [2] $C422_1$ ($\mathbf{a}' = 2\mathbf{a}, \mathbf{b}' = 2\mathbf{b}$) ($P42_12, 90$); [2] $F422$ ($\mathbf{a}' = 2\mathbf{a}, \mathbf{b}' = 2\mathbf{b}, \mathbf{c}' = 2\mathbf{c}$) ($I422, 97$)

Maximal isomorphic subgroups of lowest index

IIc [2] $P422$ ($\mathbf{c}' = 2\mathbf{c}$) (89); [2] $C422$ ($\mathbf{a}' = 2\mathbf{a}, \mathbf{b}' = 2\mathbf{b}$) ($P422, 89$)

Minimal non-isomorphic supergroups

I [2] $P4/mmm$ (123); [2] $P4/mcc$ (124); [2] $P4/nbm$ (125); [2] $P4/nnc$ (126); [3] $P432$ (207)

II [2] $I422$ (97)