International Tables for Crystallography (2016). Vol. A, Table 2.1.3.9, p. 168.

Table 2.1.3.9
Cell parameters a', b', γ' of the two-dimensional cell in terms of cell parameters a, b, c, α, β, γ of the three-dimensional cell for the projections listed in the space-group tables of Chapter 2.3

Projection direction	Triclinic	Monoclinic		Orthorhombic
		Unique axis b	Unique axis c	
[001]	$a' = a \sin\beta$ $b' = b \sin\alpha$ $\gamma' = 180^\circ - \gamma^*$†	$a' = a \sin\beta$ $b' = b$ $\gamma' = 90^\circ$	$a' = a$ $b' = b$ $\gamma' = \gamma$	$a' = a$ $b' = b$ $\gamma' = 90^\circ$
[100]	$a' = b \sin\gamma$ $b' = c \sin\beta$ $\gamma' = 180^\circ - \alpha^*$†	$a' = b$ $b' = c \sin\beta$ $\gamma' = 90^\circ$	$a' = b \sin\gamma$ $b' = c$ $\gamma' = 90^\circ$	$a' = b$ $b' = c$ $\gamma' = 90^\circ$
[010]	$a' = c \sin\alpha$ $b' = \alpha \sin\gamma$ $\gamma' = 180^\circ - \beta^*$†	$a' = c$ $b' = a$ $\gamma' = \beta$	$a' = c$ $b' = a \sin\gamma$ $\gamma' = 90^\circ$	$a' = c$ $b' = a$ $\gamma' = 90^\circ$

Projection direction	Tetragonal
[001]	$a' = a$ $b' = a$ $\gamma' = 90^\circ$
[100]	$a' = a$ $b' = c$ $\gamma' = 90^\circ$
[110]	$a' = (a/2)\sqrt{2}$ $b' = c$ $\gamma' = 90^\circ$

Projection direction	Hexagonal
[001]	$a' = a$ $b' = a$ $\gamma' = 120^\circ$
[100]	$a' = (a/2)\sqrt{3}$ $b' = c$ $\gamma' = 90^\circ$
[210]	$a' = a/2$ $b' = c$ $\gamma' = 90^\circ$

Projection direction	Rhombohedral‡
[111]	$a' = \frac{2}{\sqrt{3}} a \sin(\alpha/2)$ $b' = \frac{2}{\sqrt{3}} a \sin(\alpha/2)$ $\gamma' = 120^\circ$
$[1\bar{1}0]$	$a' = a \cos(\alpha/2)$ $b' = a$ $\gamma' = \delta$§
$[\bar{2}11]$	$a' = \frac{1}{\sqrt{3}} a \sqrt{1 + 2\cos\alpha}$ $b' = a \sin(\alpha/2)$ $\gamma' = 90^\circ$

Projection direction	Cubic
[001]	$a' = a$ $b' = a$ $\gamma' = 90^\circ$
[111]	$a' = a\sqrt{2/3}$ $b' = a\sqrt{2/3}$ $\gamma' = 120^\circ$
[110]	$a' = (a/2)\sqrt{2}$ $b' = a$ $\gamma' = 90^\circ$

† $\cos\alpha^* = \dfrac{\cos\beta\cos\gamma - \cos\alpha}{\sin\beta\sin\gamma}$; $\cos\beta^* = \dfrac{\cos\gamma\cos\alpha - \cos\beta}{\sin\gamma\sin\alpha}$; $\cos\gamma^* = \dfrac{\cos\alpha\cos\beta - \cos\gamma}{\sin\alpha\sin\beta}$.

‡ The entry 'Rhombohedral' refers to the primitive rhombohedral cell with $a = b = c$, $\alpha = \beta = \gamma$ (*cf.* Table 2.1.1.1).

§ $\cos\delta = \dfrac{\cos\alpha}{\cos\alpha/2}$.

cells result from projections along face diagonals of three-dimensional F cells.

Examples

(1) A body-centred lattice with centring vector $\frac{1}{2}(\mathbf{a} + \mathbf{b} + \mathbf{c})$ gives a primitive net if projected along [111], $[\bar{1}11]$, $[1\bar{1}1]$ or $[11\bar{1}]$.

(2) A C-centred lattice projects to a primitive net along the directions [110] and $[1\bar{1}0]$.

(3) An R-centred lattice described with 'hexagonal axes' (triple cell) results in a primitive net if projected along $[\bar{1}11]$, [211] or $[\bar{1}\bar{2}1]$ for the obverse setting. For the reverse setting, the corresponding directions are $[1\bar{1}1]$, $[\bar{2}\bar{1}1]$, [121]; *cf.* Table 2.1.1.2.

(ii) The projection direction is not parallel to a lattice-centring vector (general projection direction). In this case, the plane cell has the same multiplicity as the three-dimensional cell. Usually, however, this centred plane cell is unconventional and a transformation is required to obtain the conventional plane cell. This transformation has been carried out for the projection data in this volume.

Examples

(1) Projection along [010] of a cubic I-centred cell leads to an unconventional quadratic c-centred plane cell. A simple cell transformation leads to the conventional quadratic p cell.

(2) Projection along [010] of an orthorhombic I-centred cell leads to a rectangular c-centred plane cell, which is conventional.

(3) Projection along [001] of an R-centred cell (both in obverse and reverse setting) results in a triple hexagonal plane cell h (the two-dimensional analogue of the H cell, *cf.* Table 2.1.1.2). A simple cell transformation leads to the conventional hexagonal p cell.