Crystals

Crystal: A periodic arrangement of atoms in space

Lattice: An infinite array of points in space
Each point has identical surroundings to all other points.

Basis: A group of atoms associated with each lattice point
(aka motif) – NOT the same as a unit cell

Point Groups

The 32 symmetries allowed about a fixed point in a crystal, derived by combining all possible combinations of non-translational (point) symmetry elements (rotations, inversions, reflections, etc.), e.g., $mm2$, $mmm$, 4, etc.

<table>
<thead>
<tr>
<th>Symmetry</th>
<th>Monoclinic</th>
<th>Orthorhombic</th>
<th>Tetragonal</th>
<th>Trigonal</th>
<th>Hexagonal</th>
<th>Cubic</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>m</td>
<td>$mm2$</td>
<td>$422$</td>
<td>3</td>
<td>$622$</td>
<td>23</td>
</tr>
<tr>
<td>2</td>
<td>3m</td>
<td>$mmm$</td>
<td>$4mm$</td>
<td>3$m$</td>
<td>$6mm$</td>
<td>$m3$</td>
</tr>
<tr>
<td>3</td>
<td>32</td>
<td>$3m$</td>
<td>$42m$</td>
<td>$3m$</td>
<td>$6mm$</td>
<td>$43m$</td>
</tr>
<tr>
<td>4</td>
<td>4</td>
<td>$mmm$</td>
<td>$4mm$</td>
<td>4$m$</td>
<td>$6mm$</td>
<td>$m3m$</td>
</tr>
</tbody>
</table>

Centrosymmetric groups (Laue groups)

- Sym axis on $c$
- Sym axes $a$, $b$, $c$
- Sym axis $c$
- Sym axis on [111]
- Sym axis on $c$
- 3fold axes on <111>