Hermann-MauguinSymbols and Identification of Symmetry

The Herman Maughan symbols are a shorthanded way of conveying the symmetry of a crystalline object. In this exercise we will identify the symmetry of some models and become more familiar with the Herman Maughan symbols. First, we have to understand what the symbols mean in the different crystal classes.

**Isometric:**

Ex: **4/m2/m** In the isometric system, *a* = *b* = *c*, *α* = *β* = *γ* = 90o. The symbols mean the following:

**4/m 2/m**

Symmetry along (┴) Symmetry along Symmetry along (┴) the

*a*, *b* and *c*. the four body diagonals. six edge diagonals.

\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

**Tetragonal:**

Ex: **4/m 2/m 2/m** In the tetragonal system, *a* = *b* ≠ *c*, *α* = *β* = *γ* = 90o. The symbols mean the following:

**4/m 2/m 2/m**

Symmetry along (┴) Symmetry along (┴) Symmetry along (┴) the

*c*. *a*, *b* (*a*1, *a*2). *a*, *b* bisectors.

\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

**Hexagonal (hexagonal):**

Ex: **6/m 2/m 2/m** In the hexagonal (hexagonal) system, *a1* = *a2 = a3* ≠ *c*, *α1* ^ *a2* ^ *a3* = 120o; *β* = 90o. The symbols mean the following:

**6/m 2/m 2/m**

Symmetry along (┴) Symmetry along (┴) Symmetry along (┴) the

*c*.  *a*1, *a*2, *a3* . *a1*, *a2, a3* bisectors.

\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

**Hexagonal (rhombohedral):**

Ex: **2/m** In the hexagonal (rhombohedral) system, *a1* = *a2 = a3* ≠ *c*, *α1* ^ *a2* ^ *a3* ^ 120o; β = 90o. The symbols mean the following:

**2/m**

Symmetry along Symmetry along (┴)

*c*.  *a*1, *a*2, *a3* .

\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

**Orthorhombic:**

Ex: **2/m 2/m 2/m** In the orthorhombic system, *a* ≠ *b* ≠ *c*, *α* = *β* = *γ* = 90o. The symbols mean the following:

**2/m 2/m 2/m**

Symmetry along (┴) Symmetry along (┴) Symmetry along (┴)

*a*. *b*. *c*.

\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

**Monoclinic:**

Ex: **2/m** In the monoclinic system, *a* ≠ *b* ≠ *c*, *α* = *γ* = 90o; *β* ≠ 90o. The symbol means the following:

**2/m**

Symmetry along (┴)

*b*.

\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

**Triclinic:**

Ex: In the triclinic system, *a* ≠ *b* ≠ *c*, *α* ≠ *β* ≠ *γ* ≠ 90o. The symbol denotes the presence or absence of a center of symmetry.

\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_