

6.2 Crystal Morphology

A crystalline species is defined as a solid composed of atoms, ions, or molecules arranged in a periodic, three-dimensional (3D) pattern. A 3D array is called a lattice, as shown in Figure 6.1. The requirement of a lattice is that each volume, which is called a unit cell, is surrounded by identical objects. Three vectors, a , b , and c , are defined in a right-handed sense for a unit cell. However, as three vectors are quite arbitrary, a unit cell is described by six scalars, a , b , c , α , β , and γ without directions (Figure 6.2). Several kinds of unit cells are possible, for example, if $a = b = c$ and $\alpha = \beta = \gamma = 90^\circ$, the unit cell is cubic. It turns out that only seven different kinds of unit cells are necessary to include all the possible lattices. These correspond to the seven crystal systems, as shown in Table 6.1.

The seven different point lattices can be obtained simply by putting points at the corners of the unit cells of the seven crystal systems. However, there are more possible arrangements of points, which do not violate the requirements of a lattice.

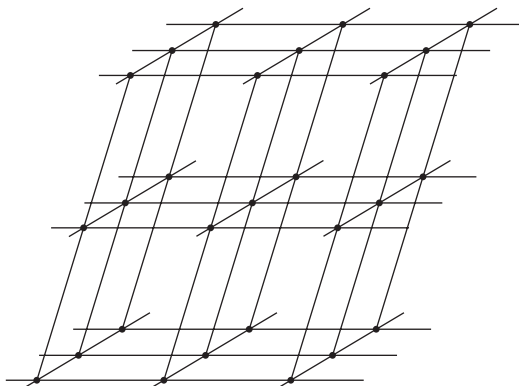


FIGURE 6.1 Crystal lattice.

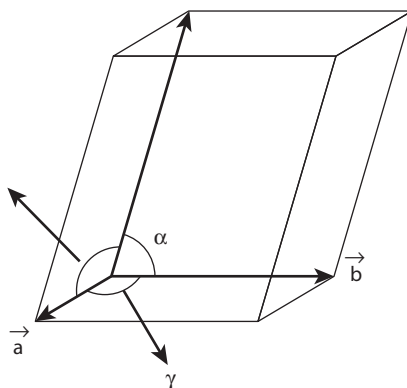


FIGURE 6.2 Scalars of lattice structure.