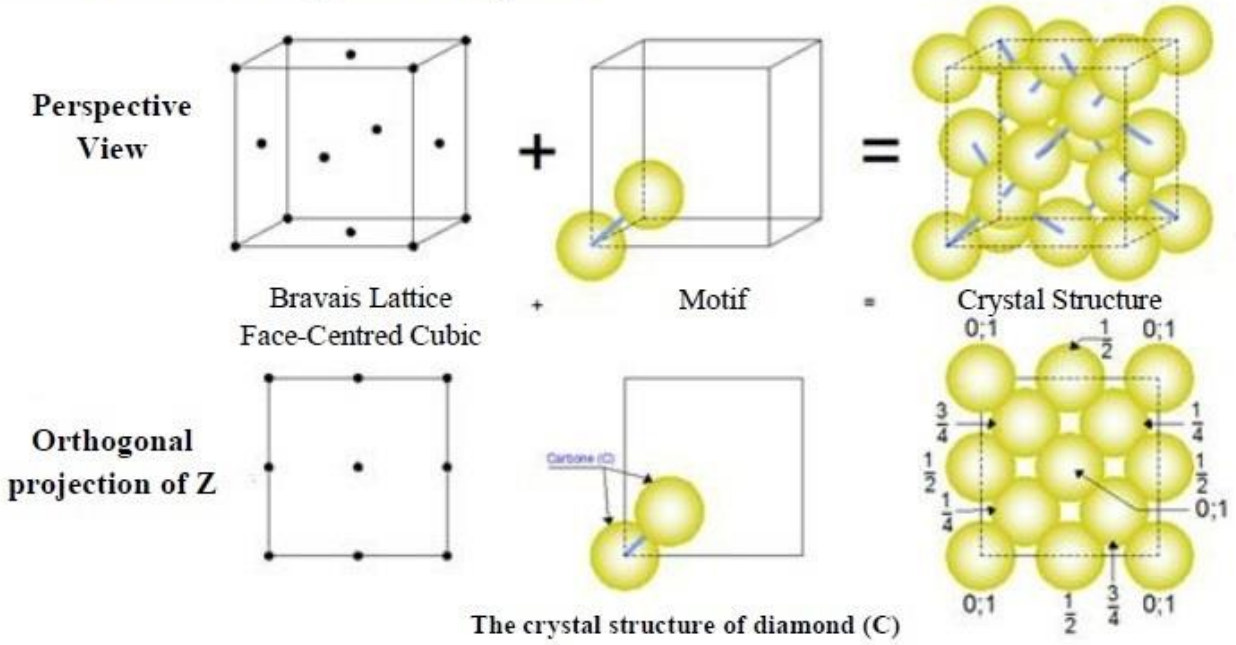
The structure of Diamond and Graphite (C)

We have selected two varieties of crystal structures composed of the same motif, carbon (C): the crystal structure of diamond and that of graphite. Diamond is defined within a face-centered cubic (FCC) lattice. The motif consists of carbon atoms occupying the vertices, the centers of the faces, and additional positions inside the cube at the coordinates: (1/4 1/4 1/4), (3/4 1/4 3/4), (1/4 3/4 3/4), and (3/4 3/4 1/4)

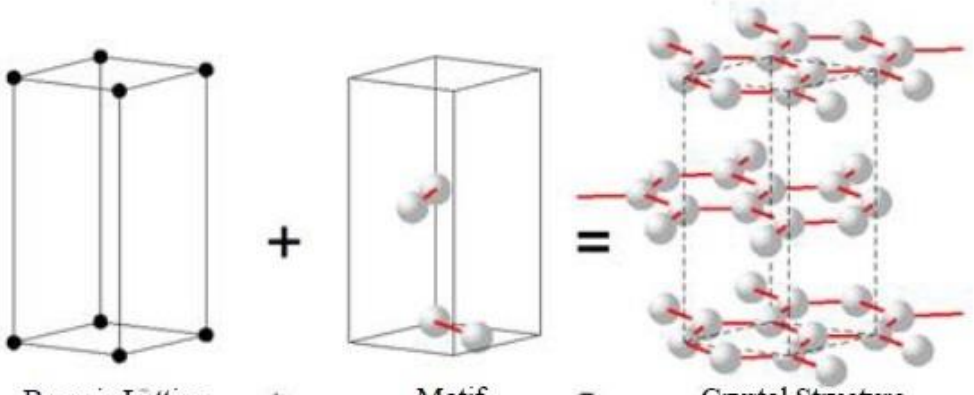
Graphite, on the other hand, has a more complex structure composed of hexagonal carbon chains arranged in parallel sheets, with a significant distance between them. It is defined within a hexagonal lattice based on a rhombus with an angle of 120° ($2\pi/3$)

Both structures (Diamond and Graphite) belong to the family of covalent bond crystals. However, unlike diamond, graphite is a soft solid and an excellent electrical conductor. This difference in properties arises from the distinct arrangements of carbon atoms in their respective structures. Diamond's tightly bonded three-dimensional network gives it exceptional hardness, while graphite's layered structure allows for electrical conductivity and a softer texture. These examples illustrate how the same element can form vastly different materials based on its crystalline arrangement.



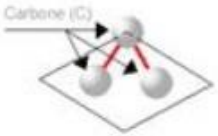
The crystal structure of diamond (C)

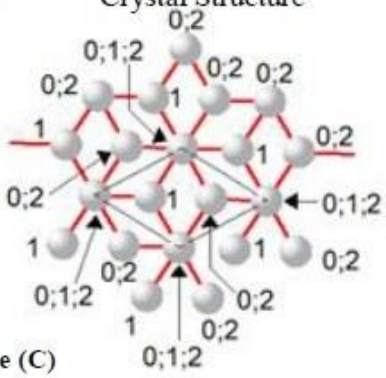
Perspective View



Bravais Lattice Hexagonal with a rhombus base ($2\pi/3$) + Motif = Crystal Structure

Orthogonal projection of Z





The crystal structure of graphite (C)