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"CRYSTAL LATTICE FORMS IN METALS"

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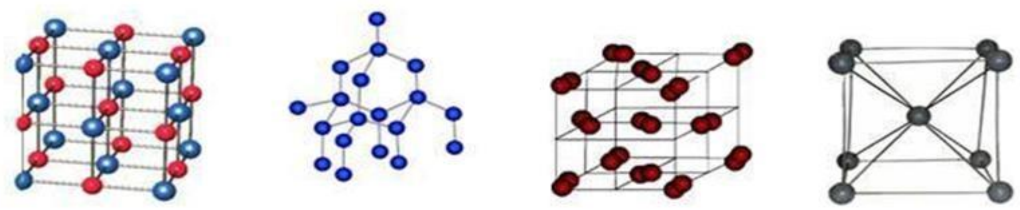
Abstract: In this article, the types of bonding of metals, crystal lattice shapes, Miller indices, crystalline iodine, sulfur, white phosphorus, carbon dioxide, crystal structure of methane elements, types of crystal lattices of some metals and their parameters, the main types of crystal lattices and sodium chloride crystal Information such as structure is widely covered.

Key words: Crystal, Miller indices, carbon dioxide, methane, parameter, sodium chloride, fluorspar, corundum, ruby, silicon oxide, mineral, quartz

Enter: The development of industry and the achievements of mechanical engineering are largely related to the creation and use of strong, stable, light (especially in aviation) metallic and non- metallic materials. The requirements for the material depend on its operating conditions: mechanical loading, temperature, the influence of the external environment, etc. For example, the frictional parts of the tractor must be resistant to abrasive wear (especially in the conditions of Central Asia); cotton picker spindles should be made of material resistant to both abrasive and chemical corrosion; aircraft struts (longer, stringer, etc.) are made of material with static strength and high stiffness; fire resistance-heat resistance (650-850ºC) requirements are imposed on aircraft engine material; the upper layer ("paning") of supersonic aircraft is made of light materials operating at 350-550ºC. It should be said that composite materials (including nanomaterials) are increasingly used in modern machines. Their volume reaches from 5-10% to 70-80%. Composite materials have excellent special properties. High precision; resistance to abrasion; heat and low conductivity; if necessary, it can be superconducting material; chemical stability, good light transmission.



a) b) s) d)

Figure 1. a) ionic bond; b) atomic bonding; c) molecular bond; d) metal bond

Dependence of properties of substances on the type of crystal lattice. At the nodes of the atomic crystal lattice, there are atoms connected by covalent bonds. Examples of atomic crystal lattice substances are diamond, silicon, germanium, boron. Substances with an atomic crystal lattice are characterized by a high melting point and hardness. There are positive and negative ions in the ionic crystal lattice, and the bond between them is ionic. Salts, alkalis and oxides of metals usually have an ionic crystal lattice. Ionic crystal lattice substances are characterized by high melting points, hardness, density and good electrical conductivity [6].

In the places where the molecular crystal lattice is located, there are molecules that are held together by intermolecular Van Der Waals forces. Examples of substances with a molecular crystal lattice are ice, iodine, naphthalene, and carbon dioxide. Intermolecular bonds are much weaker than covalent and ionic bonds; therefore, substances with a molecular crystal lattice are distinguished by low melting points, low hardness and the possibility of sublimation (transition from a solid state to a gas state, bypassing the liquid state)[1]. Metals are characterized by a metallic crystal lattice, the nodes of which contain positively charged metal ions, and valence electrons (called electron gas) move freely between them. Metal lattice materials are characterized by mechanical strength, solubility, flexibility, good thermal and electrical conductivity, and metallic luster. The properties of crystalline bodies are determined not only by the nature of the connection between particles, but also by their mutual location in relation to each other. In diamond crystals, all carbon atoms are connected by non-polar covalent bonds and are located at the same distance from each other, forming tetrahedra. In graphite crystals, all six carbon atoms are connected by non-polar covalent bonds, and such planar hexagons are connected by weak intermolecular bonds. For substances with an ionic type of bond, the following properties are characteristic: high melting and boiling temperatures, they are refractory and non-volatile, they are hard, brittle and most of them are soluble in water. Their fragility is that if you try to deform such a crystal lattice, then one of its layers will move relative to the other layer until the ions of equal charge are opposite each other. These ions begin to displace each other and the crystal lattice relaxes. Ionic compounds are poor conductors of electricity and heat. But their solutions and solutions conduct electricity. Substances with ionic compounds are odorless. An ionic compound is a large association of ions that are held together in space due to the balance of attractive and repulsive forces [5].

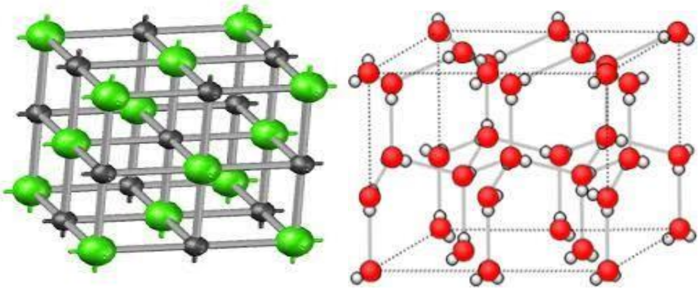


Figure 2. Crystal structure of sodium chloride.

For example, sodium chloride crystals consist of sodium cations and chlorine anions. Each sodium cation is surrounded by six chlorine anions, and each chlorine anion is surrounded

Body-Centered Cubic (BCC):

The atoms are located at each corner of a cube and one atom in the center of the cube.

Common metals with BCC structure: Iron (at low temperatures), Chromium, Tungsten, etc.

BCC metals typically have high melting points and are less ductile than FCC metals.

Face-Centered Cubic (FCC):

Atoms are located at each corner and the centers of each face of the cube.

Common metals with FCC structure: Copper, Aluminum, Gold, Silver, etc.

FCC metals tend to be more ductile and have better formability at room temperature compared to BCC metals.

Hexagonal Close-Packed (HCP):

Atoms are arranged in a hexagonal pattern, with two atoms in the middle layer.

Common metals with HCP structure: Titanium, Magnesium, Zinc, etc.

HCP metals are known for their high strength but limited ductility in certain conditions.

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