- Chiayi Shen (editor), H. Ralph Rawls (editor), Josephine F. Esqu Phillips' Science of Dental Materials (2021, Saunders)
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 - Definitions

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Adhesion An attraction between two contacting surfaces promoted by the interfacial force of attraction between the molecules or atoms of two different species; adhesion may occur as chemical adhesion, mechanical adhesion (struc...

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- Ceramic Solid-phase compounds of metallic and nonmetallic elements.
- Cohesion Bonding between molecules or atoms of the same species
- **Alloy** and alloy system An alloy is a crystalline solid with metallic properties that is composed of two or more eleme...
- **Composite** A material made of two or more constituent components with significantly different physical or chemical properties that, when combined, produce a material with characteristics different from the individual components....

A random copolymer is when there is no sequential order of monomer types along the polymer chain. A block copolymer is when groups of each type of monomer appear in the same polymer chain. A graft or branched copolymer is when a sequence of one type of mer unit is grafted onto the backbone of a second type of monomer to the back

- **Curing** Chemical reaction in which low-molecular-weight monomers are converted into higher-molecular-weight m...
- **Glass-transition temperature (Tg**) (1) The temperature above which a sharp increase in the thermal expansion coefficient occurs, indicating increased molecular mobility. (2) The temperature at which macromolecule molecular motion begins to force the polymer chains apart. Thus polymeric materials soften when heated above this temperat...
- Grain and grain boundary A grain is a single crystal in the microstructure of a metal. Metals and alloys are solids co...
- Phase and phase diagram (constitution diagram) A graph of equilibrium phases and solubility limits for an alloy sy...
- **Resin or synthetic resin** Blend of monomers and/or macromolecules with other components, which form a materia...
- **Strain** Magnitude of deformation (stretching, compression, or shear) occurring in response to an applied force
- **Stress** The perpendicularly directed force, exerted as pressure or tension, on a material that causes the object to de...
- **Surface energy** The excess energy of attraction that the surface of a material (liquid and solid) has compared with the bulk of the material because molecules or atoms at the surface are not surrounded by their fellows as those in the b...

In dentistry, ionic bonding exists in some dental materials, such as in gypsum and phosphate-based cements Types of Bonding (32) **Primary Bonds** (32) (33) + Shared electrons В С Α lonic bond • Figure 2-4 Primary bonds. A, Ionic bond, characterized by electron transfer from one element (Na) to another (Cl). B, Covalent bond, characterized by electron sharing and very precise bond orientations. Fluorine molecules (F2) share one pair of electrons. C, Metallic bond, characterized by electron sharing and the formation of a "cloud" of electrons that bonds to the positively charged nucleus in a lattice. (32) Ionic Bonds (32) **Covalent Bonds** (33) Metallic Bonds (29) **Metal** (1) An element or alloy whose atoms readily lose electrons to form positively charged ions. (2) A metallic material composed of one or more elements that is opaque, ductile, relatively malleable, a good conductor of el... (33) • The electromagnetic attraction between the electron cloud and the positive ions in the lattice provides the force that bonds the metal atoms together as a solid. The free electrons give the metal its characteristically high thermal and electrical conductivity. These electrons absorb light energy, so all metals are opaque to transmitted light. The metallic bonds

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In contrast with primary bonds, secondary bonds do not share electrons between molecules. Instead, the asymmetrical distribution of electrons within each molecule induces dipole forces that attract molecules together.



Van der Waals Forces

Van der Waals forces of attraction arise from dipole attractions (Figure 2-5). In the case of polar molecules, dipoles are induced by an unequal sharing of electrons (Figure 2-5, A)

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• In the solid state, atoms combine in a manner that ensures minimal internal energy and the most efficient packing of atoms.

For example, sodium and chlorine share one electron at the atomic scale. In the solid state, like grains of salt, they do not exist in individual pairs; in fact, each sodium ion is attracted to six chlorine ions, and vice versa (Figure 2-7). They form a regularly spaced configuration (long-range repetitive space lattice) known as a crystal

• There are structures where regularly spaced configurations do not occur in the solid state. For example, the molecules of some of the waxes used by a dentist or laboratory technician are distributed at random when solidified. This noncrystalline formation is also known as an amorphous structure

Crystalline Structure



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