

## Glossary

**Anions** are negatively charged ions with more electrons than protons.

**Atoms** are the smallest "units" of any chemical element.

**Biocompatible** is the ability of a material to perform its function with an appropriate host response without causing (any) undesirable local and systemic effects.

**Biomaterials** is a substance that has been engineered to interact with biological systems for a medical purpose, either a therapeutic (treat, augment, repair, or replace a tissue function of the body) or a diagnostic one

**Cations** are positively charged ions with fewer electrons than protons.

**Ceramic materials** are inorganic solids composed of metallic and non-metallic elements.

**Chain-growth polymerization** is a polymerization technique where monomer molecules attach one at a time to the active site of a growing polymer chain.

**Chemical equilibrium** is the state in which both the reactants and products are present in concentrations which have no tendency to change with time.

**Composites** are materials formed by combining two or more compounds with different chemical and physical properties, without dissolving or blending them into each other.

**Cross-linking** refers to the process of joining two or more polymer chains together, usually with the aim of changing the physical properties of a material.

**Design space** in biomaterial engineering is the sum of all possible chemical or physical properties that a given material system can adopt.

**Hybrid polymers** are semi-synthetic polymers derived from naturally occurring ones after chemical modifications.

**Hydrogen bond** is a primarily electrostatic force of attraction between a hydrogen atom which is covalently bound to a more electronegative atom or group, and another electronegative atom bearing a lone pair of electrons—the hydrogen bond acceptor

**Hydrolysis** is any chemical reaction in which a molecule of water breaks one or more chemical bonds.

**Hydrophilic** substances interact readily with water.

**Hydrophobic** substances avoid contact with water.

**Intramolecular interactions** is the interaction between molecules, induced by forces including the electromagnetic forces of attraction or repulsion which act between atoms and other types of neighboring particles, e.g. atoms or ions.

**Ions** are atoms or molecules with a net negative electrical charge. Ions are different than cations, which have a net positive charge.

**Loss modulus** is a viscoelastic response of a material, which dissipates energy over time after the application of strain.

**Natural polymers** also called biopolymers, are polymers produced by living organisms.

**Olefins** are unsaturated hydrocarbons, compounds that contain only hydrogen and carbon and at least one double or triple covalent bond.

**Peptide bond** is an amide type of covalent chemical bond linking two consecutive alpha-amino acids from C<sub>1</sub> of one alpha-amino acid and N<sub>2</sub> of another, along a peptide or protein chain.

**Polymerization process** is the chemical reaction which allows monomers to bind covalently.

**Polymers** are substances or materials consisting of very large molecules, or macromolecules, composed of many repeating subunits.

**Rational design** is the strategy of creating new molecules with a certain functionality, based upon the ability to predict how the molecule's structure will affect its function.

**Regenerative medicine** deals with the process of replacing, engineering, or regenerating human or animal cells, tissues, or organs to restore or establish normal function.

**Responsiveness** is the quality of a biomaterial to respond to stimuli.

**Selectivity** is the preference of a chemical reaction to generate one product over the another.

**Semisynthetic biomaterials** are derived from chemical modification of a natural biomaterial to improve function. E.g., crosslinking of collagen to increase stiffness.

**Smart biomaterials** respond to stimuli and environmental changes and activate their function in response to the stimulus.

**Step-growth polymerization** refers to a type of polymerization mechanism in which bi-functional or multifunctional monomers react to form first dimers, then trimers, longer oligomers (composed of 3 to 10 monomers) and eventually long chain polymers.

**Stimuli-responsive** are polymers that are sensitive to triggers from the external environment, including temperature, light, electrical or magnetic fields, and chemicals.

**Storage modulus** is a property of viscoelastic materials and refers to the ratio of stress to strain under vibratory conditions.

**Stress relaxation** is the observed decrease in stress in response to strain generated to a biomaterial.

**Structure-property relationship** is the relationship between the structure and the way a biomaterial behaves.

**Supramolecular interactions** are a class of interactions categorized by their non-covalent character. Examples are der Waals forces, pi-pi stacking, hydrogen bonding, metal-ligand coordination, and electrostatic interactions.

**Synthetic polymers** are prepared by scientists in the laboratory and scaled up by engineers in factories.

**Theranostics** are nano-size or molecular-level agents serving for both diagnosis and therapy.

**Tissue engineering** is the design and fabrication of living replacement devices for surgical reconstruction and transplantation.

**Viscoelastic** is a property of materials to exhibit both viscous and elastic characteristics when undergoing deformation.

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