Plastics

Materials that can be reshaped (remolded) by applying heat and pressure. Most plastics are made from synthetic resins (polymers) through the industrial process of polymerization. Two main types of plastics are thermoplastics and thermosets.

Two basic types of plastics
Thermosets- Heat hardening/ Undergoes chemical change
Thermoplastics- Heat softening/ Undergoes physical change

1. Thermosets
General properties: more durable, harder, tough, light.
Typical uses: automobile parts, construction materials

Examples:
Unsaturated Polyesters: lacquers, varnishes, boat hulls, furniture
Epoxies and Resins: glues, coating of electrical circuits, composites: fiberglass in helicopter blades, boats, ...

2. Elastomers
General properties: these are thermosets, and have rubber-like properties.
Typical uses: medical masks, gloves, rubber-substitutes
Examples:
Polyurethanes: mattress, cushion, insulation, toys
Silicones: surgical gloves, oxygen masks in medical applications joint seals

3. Thermoplastics
General properties: low melting point, softer, flexible.
Typical uses: bottles, food wrappers, toys, …

**Examples:**
- Polyethylene: packaging, electrical insulation, milk and water bottles, packaging film
- Polypropylene: carpet fibers, automotive bumpers, microwave containers, prosthetics
- Polyvinyl chloride (PVC): electrical cables cover, credit cards, car instrument panels
- Polystyrene: disposable spoons, forks, Styrofoam™
- Acrylics (PMMa: polymethyl methacrylate): paints, fake fur, plexiglass
- Polyamide (nylon): textiles and fabrics, gears, bushing and washers, bearings
- PET (polyethylene terephthalate): bottles for acidic foods like juices, food trays
- PTFE (polytetrafluoroethylene): non-stick coating, Gore-Tex™ (raincoats), dental floss

**Advantages**
- Light Weight
- High Strength-to-Weight Ratio
- Complex Parts - Net Shape
- Variety of Colors (or Clear)
- Corrosion Resistant
- Electrical Insulation
- Thermal Insulation
- High Damping Coefficient
- “Low” pressures and temp required

**Disadvantages**
- Creep
- Thermally Unstable- Can’t withstand Extreme Heat
- U-V Light Sensitive
- Relatively low stiffness
- Relatively low strength
- Difficult to Repair/Rework
- Difficult to Sort/Recycle

**Plastic Manufacturing Processes**
A wide variety of plastic manufacturing processes exist
- Extrusion
- Lamination (Calendering)
- Thermal Forming
- Foaming
- Molding
- Expansion
- Solid-Phase Forming
- Casting
- Spinning

Source: [http://nprcet.org/e%20content/mech/MT.pdf](http://nprcet.org/e%20content/mech/MT.pdf)