Processing of Polymers

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Subject: Materials Sciences

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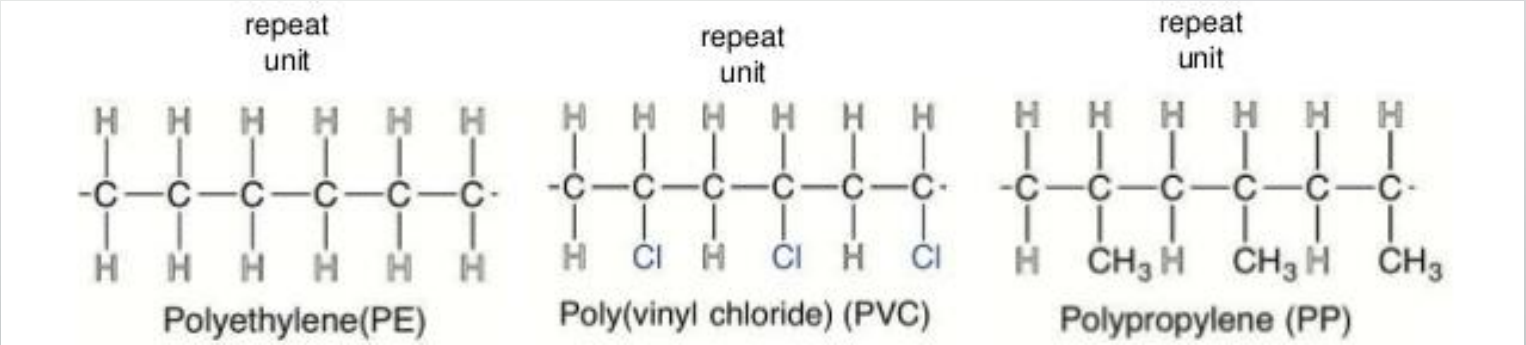
Mechanical Engineering

Polymers

Poly **mer**
Many **Units**

- A substance that has a molecular structure consisting entirely of a large number of similar units bonded together.



- Man kind has used natural polymeric materials such as wood, leather and wool since the beginning of history, but synthetic polymers became possible only after the development of rubber technology in the 1800s.

Celluloid

- The first synthetic polymer material, was invented by John Wesley Hyatt in 1869, from cellulose nitrate and camphor.

- The invention of Bakelite
- By Leo Hendrik Baekeland in 1907

- The growth of the polymer industry started shortly before the Second World War
  - Acrylic polymers
  - Polystyrene
  - Nylon
  - Polyurethanes
  - Polyethylene
  - Polyethylene terephthalate
  - Polypropylene

- The production of plastics in volume surpassed that of steel for the first time in 1981.

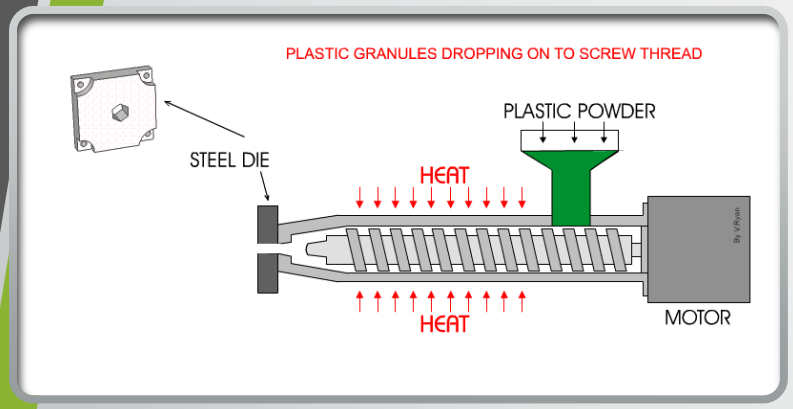
Processing of Polymers

- Melt Processing
- Solution Processing
- Dispersion Processing

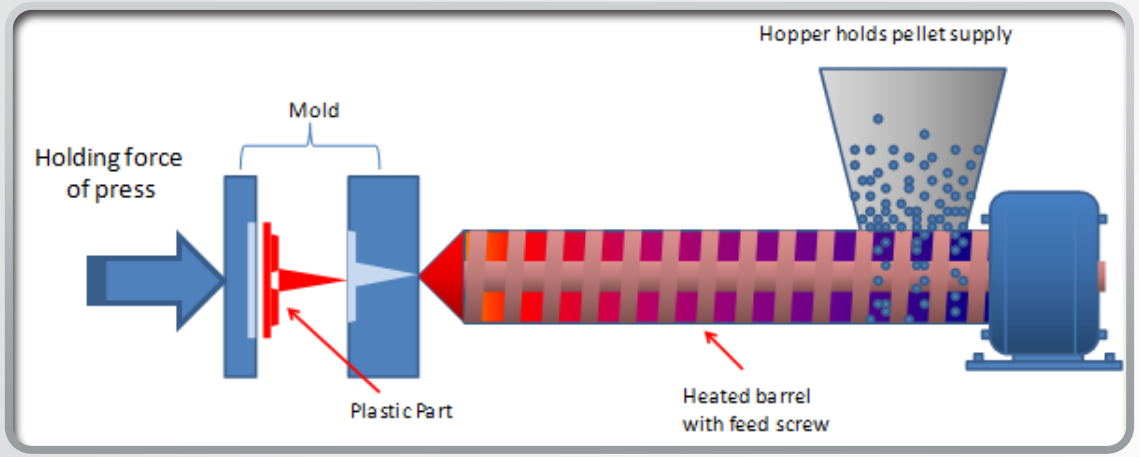
Melt Processing

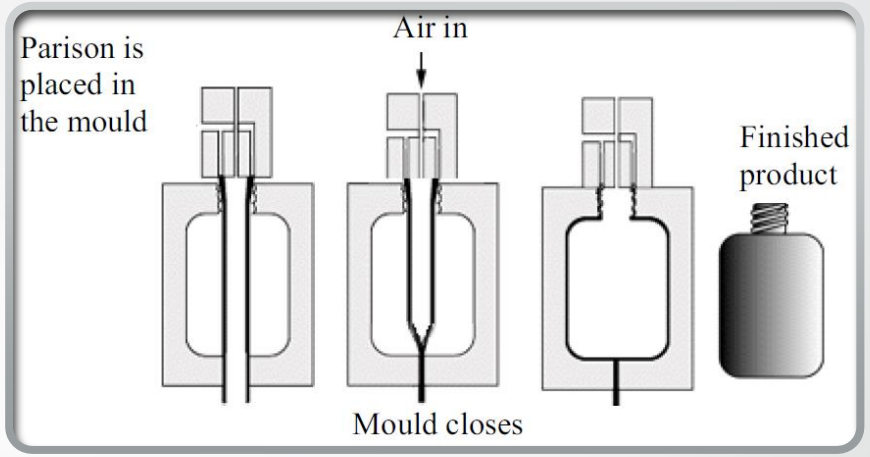
- It is used for polymers that become liquid at elevated temperatures so that they can be extruded into fibers, films, tubes, or other linear shapes or molded into parts of complex shape.
  - **Extrusion**
  - **Molding**
  - **Solid-State Forming**

Extrusion



- The most convenient, economical, and environmentally favorable for film and sheet manufacturing.





Molding

- Processes involving thermosets and thermoplastics
  - Injection molding
  - Blow molding.

Solid-State forming

- Useful for increasing strength and modulus of polymeric materials.
- The latter involves achieving morphologies with well-aligned, extended, and closely packed chains.
  - Synthesizing rigid rodlike polymers containing parasubstituted aromatic structures in the chain backbone .
  - Processing conventional flexible chain polymers in ways that lead to similar results.

Solution Processing

- Certain polymers have such strong interchain bonding that they do not melt or flow when heated until they reach temperatures at which chemical degradation occurs.
- Often such materials are soluble only in aggressive solvents such as sulfuric acid.

Dispersion Processing

- Key technique that is likely to grow in importance, driven by both environmental and materials considerations.
- The polymer may be in the form of a dry powder, an aqueous dispersion, or a nonaqueous dispersion.

Conclusions

References

- Dr. J. Vlachopoulos. Dr. Strutt. (2003). Overview: Polymer Processing. Canada: Maney for the Institute of Materials, Minerals and Mining.
- Committee on Polymer Science and Engineering. Board on Chemical Sciences and Technology. Commission on Physical Sciences, Mathematics, and Applications. National Research Council. (1994). Chapter: 3. Manufacturing: Materials and Processing. En Polymer Science and Engineering: The Shifting Research Frontiers(65-115). Washington, D.C.: National Academy of Sciences.
- Andrea Picks: The Saga of Cellulose Archived January 24, 2010, at the Wayback Machine.
- Stephen Fenichell, Plastic: The Making of a Synthetic Century, p. 17.
- Laughton M A; Say M G (2013). Electrical Engineer's Reference Book. Elsevier. p. 1.21.
- White: 'Principles of polymer engineering rheology'; 1990New York, Wiley.,
- D. H. Morton-Jones: 'Polymer Processing'; 1989, London, Chapman and Hall.
- H. U. Schenck: AIM Mag.; (Special issue: 'Polymers in Europe') 2001, 15 – 18.
- Society of the Plastics Industry: 'The Size and impact of the plastics industry'; 2001, Washington, DC, SPI.

References

- Barbero., E., and H.V.F. Gangarao. 1991. "Structural Applications of Composites in Infrastructure." SAMPE Journal 27 (No. 6, Nov./Dec.):9.
- Chemical & Engineering News. 1991. Vol. 69, No. 23, June 10, p. 39.
- Chemical & Engineering News. 1992. "Facts & Figures for the Chemical Industry." Vol. 70, No. 26, June 29, pp. 62-63.
- Chemical & Engineering News. 1993. "Facts & Figures for the Chemical Industry." Vol. 71, No. 26, June 28, pp. 38-83.
- McDermott, J. 1993. Advanced Composites: 1993 Blue Book. Cleveland, Ohio: Advanstar Communications.
- Modern Plastics. 1982. "Materials 1982: A Modern Plastics Special Report." Vol. 59, No. 1, January, pp. 55-87.
- Modern Plastics. 1992. "Resins 1992: Supply Patterns Are Changing." Vol. 69, No. 1, January, pp. 53-96.
- Pasztor, A. 1992. "Composites Makers Take Aim at Nondefense Markets; As Pentagon Budget Shrinks, Firms Seek to Dispel Cost, Safety Concerns." Wall Street Journal. August 26, pp. B3-B4.
- Strathman, H. 1991. Effective Industrial Membrane Processes: Benefits and Opportunities, M.K. Turner, ed. New York: Elsevier.