

## 3.082 - Polymer Processing

Polymers are commonly used in low temperature applications requiring complex three-dimensional shapes. Real economic value usually requires high-volume production to recoup high initial capital outlay.

Net-shape forming is commonly accomplished using an injection molding process. Plastic pellets are fed through a hopper into a reciprocating extruder screw. The flights of the rotating screw cause the material to move through a heated barrel where the material softens so that it may be fed into the shot chamber. The liquid is injected at pressure into the thermally conditioned mold. At a pre-determined pressure, disengaging the extruder from the mold inlet halts the flow. After allowing the fluid to harden, the mold is opened and the finished part is released. Design of the mold and evaluating the optimal processing parameters to provide for a perfect part is an extremely complex process. Typical projects include dental inserts for braces, cell phone clips and bicycle gear shifts.

For parts that are characterized by a thin geometry, thermoforming is used. This process involves heating a thermoplastic sheet to its softening point, forcing the hot and flexible material onto the contours of a mold, and applying differential pressure, usually by pneumatic means, to form the final shape. Deep draws are permissible with proper design of the die. The ease of forming depends on the material characteristics, the thermal profile, the mold geometry and the thickness of the sheet. Typical projects include canoe paddles, toys, and contact lenses.