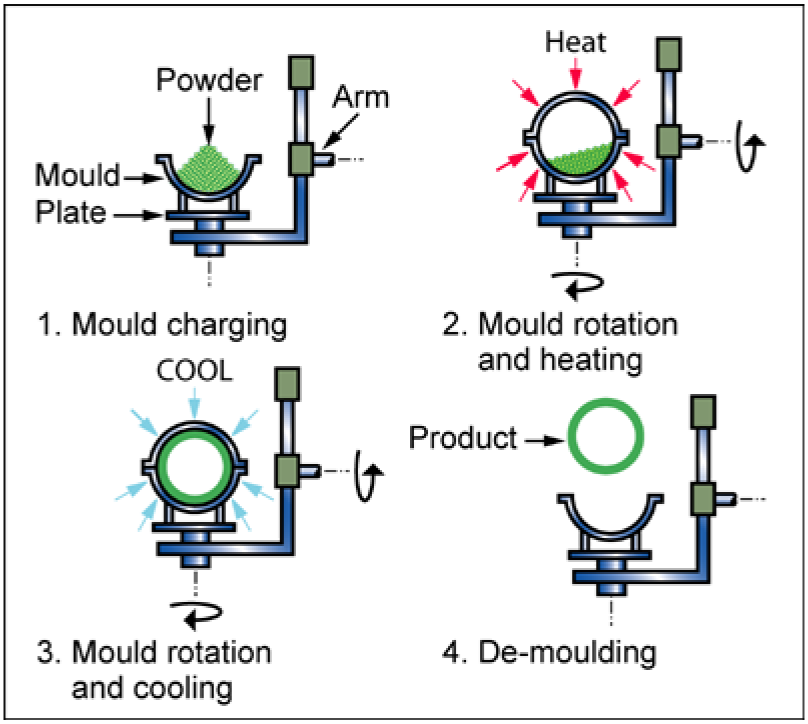
Rotational molding

Description

Process schematic



The process

The chunky, brightly-colored chairs for children are examples of what can be done with ROTATIONAL MOLDING. First a pre-measured quantity of polymer powder is fed into a cold die, which is then heated in a large oven while it is rotated about two axes simultaneously. This tumbles and melts the powder, coating the inside walls of the mold to a thickness set by the initial load of powder, creating a hollow shell. The component then cools in a dwell cycle, the mold chilled by air or water spray. The process is best suited for components that are large, hollow and closed; although small, thin-walled components can be made and open shapes can be created by subsequent machining.

Material compatibility

Polymers - thermoplastics	✔

Shape

Dished sheet	✔
Hollow 3-D	✔

Economic compatibility

Relative tooling cost	low			
Relative equipment cost	low			
Labor intensity	high			
Economic batch size (units)	50	-	5e3	

Physical and quality attributes

Mass range	* 0.22	-	110	lb

Range of section thickness	98.4	-	236	mil
Tolerance	15.7	-	39.4	mil
Roughness	0.0197	-	0.063	mil
Surface roughness (A=v. smooth)	A			

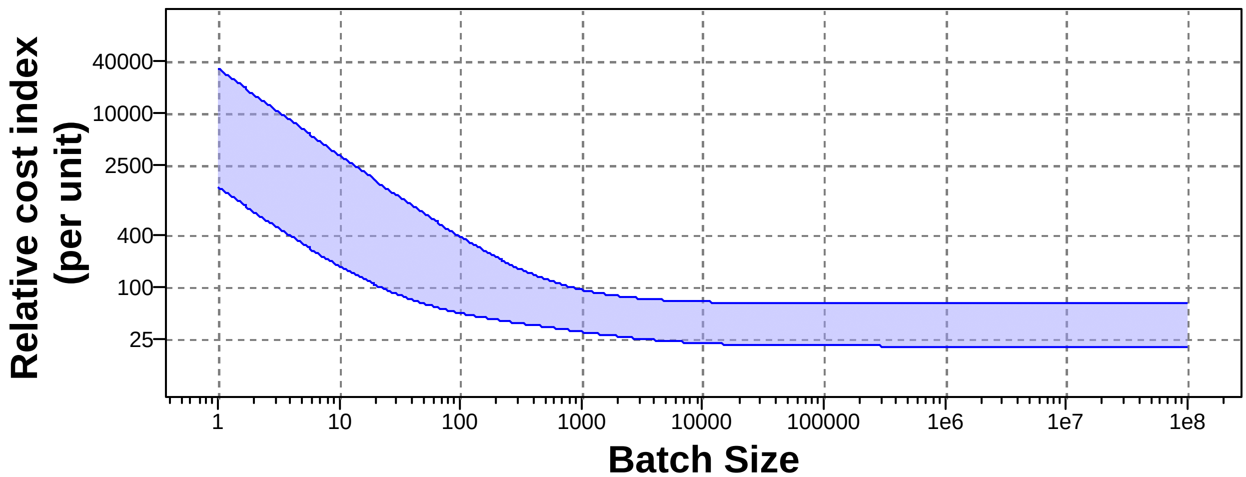
Process characteristics

Primary shaping processes	✓
Discrete	✓

Cost model and defaults

Relative cost index (per unit)	* 30.9	-	94.2

Parameters: Material Cost = 3.63USD/lb, Component Mass = 2.2lb, Batch Size = 1e3, Overhead Rate = 150USD/hr, Discount Rate = 5%, Capital Write-off Time = 5yrs, Load Factor = 0.5



Material Cost=3.63USD/lb, Component Mass=2.2lb, Overhead Rate=150USD/hr, Capital Write-off Time=5yrs, Load Factor=0.5, Discount Rate=5%

Capital cost	* 1.64e3	-	1.64e4	USD
Material utilization fraction	* 0.95	-	0.99	
Production rate (units)	* 3	-	20	/hr
Tooling cost	* 1.39e3	-	3.28e4	USD
Tool life (units)	* 1e3	-	1e4	

Supporting information

Design guidelines

Rotational molding is versatile, and one of the few processes able to make hollow (and thus material-efficient) shapes. The low pressure limits the possible sharpness of detail, favoring rounded forms without finely-detailed moldings. Inserts and pre-formed sections of different color or material can be molded in, allowing scope for creativity. Components with large openings - trash cans and road cones, for example - are molded in pairs and separated later.

Technical notes

In principle, most thermoplastics can be rotationally molded, though in normal practice the range is more restricted - the most common is polyethylene. The process makes large components, but the thickness is limited by the thermal conductivity of the polymer, since it has to melt through this thickness. One advantage: it produces virtually stress-free components. It is possible (but difficult) to vary the wall thickness; abrupt changes of section are not possible. Because of the two axes rotation, component length is restricted to less than 4 times the diameter. Thermosets can now be rotationally molded too - polyurethane is the most usual.

Typical uses

Very wide range. Tanks, food and shipping containers, housings, portable lavatories, traffic cones, toys (e.g. balls), dustbins, buckets, boat building, hulls, pallets, etc.

The economics

Equipment and tooling costs are low - much lower than for injection molding - but cycle times are longer than any other molding process, and it is labor-intensive.

The environment

No problems here.

Links

MaterialUniverse

Reference