

Polymer processing methods - An easy guide

(The right process for the job - reducing costs by the right choice)



1. Thermoplastics Processing Methods

- Thermoplastics are materials which soften when heated and can then be formed whilst soft. After cooling they becoming rigid take up the applied form. The softening and forming processes are reversible. Thermoplastics are probably the most widely used type of polymer. The group includes most of the “commodity” plastics such as polyethylene, PVC, polypropylene, nylons (polyamides) and polystyrene.

Thermoplastic Processing Methods					
Processing Method	Equipment Cost	Tooling Cost	Cycle Time	Precision	Economic Quantity
Extrusion	A	B	D	A	D
Injection Moulding	A	A	A	A	A
Blow Moulding	A	B	A	B	A
Rotational Moulding	B	C	C	B	B
Thermoforming	B	C	B	C	B

Key				
	A	B	C	D
Costs	High	Moderate	Low	
Time	<1 min	1-3 min	>3 min	Continuous
Precision	Good	Moderate	Poor	Not applicable
Quantity	> 10K	100 to 10K	<100	>5Km

2. Polymers and Processing Methods

- Not all thermoplastics can be processed by all the methods. This table is a guide to what thermoplastics can be processed by each method.

Polymers and Processing Methods						
Material	Process	Extrusion	Injection Moulding	Blow Moulding	Rotational Moulding	Thermo-forming
ABS		Yes	Yes	No	Yes	Yes
EVA		No	No	No	Yes	No
PA		Yes	Yes	No	Yes	No
PC		Yes	Yes	Yes	No	Yes
PE-LD		Yes	Yes	Yes	Yes	No
PE-HD		Yes	Yes	Yes	Yes	No
PMMA		Yes	Yes	No	No	Yes
POM		Yes	Yes	Yes	No	No
PP		Yes	Yes	Ye	No	Yes
PS / PS-HI		Yes	Yes	Yes	Yes	Yes
PVC-U		Yes	Yes	Yes	Yes	Yes
PVC-P		Yes	Yes	Yes	Yes	Yes
SAN		Yes	Yes	Yes	No	No

3. Thermosetting Processing Methods

- Thermosetting materials are materials that are formed whilst warm or hot but once formed they set in the formed shape. Cooling and reheating do not make thermosetting materials go soft again. The forming process is not reversible. Thermosetting materials were the first type of polymer to be produced e.g. Bakelite, but are still widely used for many applications. Typical thermosetting materials are phenol formaldehyde resins, urea formaldehyde resins, epoxy resins and most rubbers.

Thermoset Processing Methods					
Processing Method	Equipment Cost	Tooling Cost	Cycle Time	Precision	Economic Quantity
Compression Moulding	B	A	B	A	A
Transfer Moulding	B	A	B	A	A
Injection Moulding	A	A	A	A	A
Liquid Casting	D	C	C	B	C
DMC and SMC	B	A	B	A	A
RIM and RRIM	B	B	B	B	B
GRP (Hand Lay-up)	D	C	C	C	C
GRP (Spray and Match Die)	B	B	B	B	B
Filament Winding	B	C	C	C	C
Pultrusion	B	B	D	B	D

Key				
	A	B	C	D
Costs	High	Moderate	Low	None
Time	<2 min	2-5 min	>5 min	Continuous
Precision	Good	Moderate	Poor	Not applicable
Quantity	> 10K	100 to 10K	<100	>5Km

4. Features and Processing Methods

Features and Processing Methods						
Feature	Process	Extrusion	Injection Moulding	Blow Moulding	Rotational Moulding	Thermo-forming
Equipment Cost		High	High	High	Moderate	Moderate
Tooling Cost		Moderate	High	Moderate	Low	Low
Cycle Time		Continuous	<1 min	<1 min	>3 min	1-3 min
Economic Quantity		>5Km	>10K	>10K	100 - 10K	100 - 10K
Precision		Good	Good	Moderate	Moderate	Low
Wall Thickness Control		Yes	Yes	No	No	No
Open-ended Hollows		No	Yes	Yes	Yes	Yes
Enclosed Hollows		No	No	Yes	Yes	No
Very Small Items		No	Yes	No	No	No
Intricate Shapes		Yes	Yes	Yes	No	No
Large Enclosed Volumes		No	No	Yes	Yes	No
Inserts		No	Yes	No	Yes	No
Moulded-in Holes		No	Yes	No	No	No
Threads		No	Yes	Yes	No	No