

Description

Image



Image caption

(1) Autoclave machine © Granta Design at TU Delft University (2) Airbus A380-800 © Joe Ravi at Wikimedia Commons (CC BY-SA 3.0)

The process

In AUTOCLAVE MOLDING, reinforcement is layed-up on the mold and the resin is applied by conventional hand or spray lay-up techniques. The laminate is backed with a porous film parting agent and a layer of glass-fiber cloth or paper to absorb any excess resin. A flexible bag is placed on top of the glass-fiber layer. The laminate and the mold are then placed inside an autoclave and subjected to pressures of about 0.55 MPa compressing the laminate, squeezing out air pockets to give a dense product free from porosity. The autoclave is often heated to accelerate curing and increase productivity. Autoclave molding is used extensively to fabricate high strength aircraft and aerospace components, particularly for thicker parts or where high fiber volume fraction is required.

Process schematic

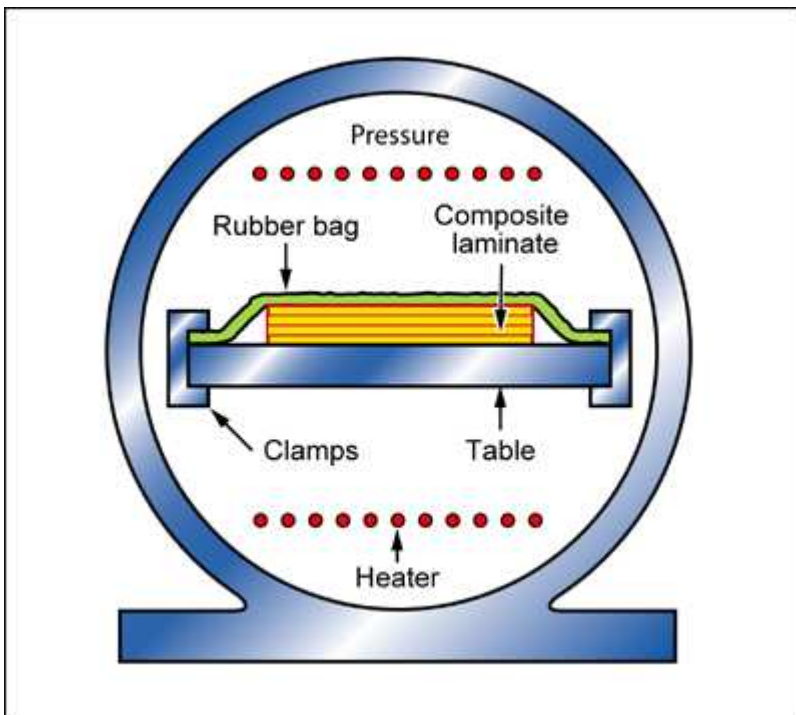


Figure caption

Autoclave molding

Material compatibility

Composites	✓
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Shape

Flat sheet	✓
Dished sheet	✓
Hollow 3-D	✓

Economic compatibility

Relative tooling cost	low
Relative equipment cost	high
Labor intensity	high
Economic batch size (units)	1 - 500

Physical and quality attributes

Mass range	0.8 - 2e3	kg
Range of section thickness	2 - 30	mm
Tolerance	* 0.8 - 1	mm
Roughness	* 0.5 - 3.2	µm
Surface roughness (A=v. smooth)	A	

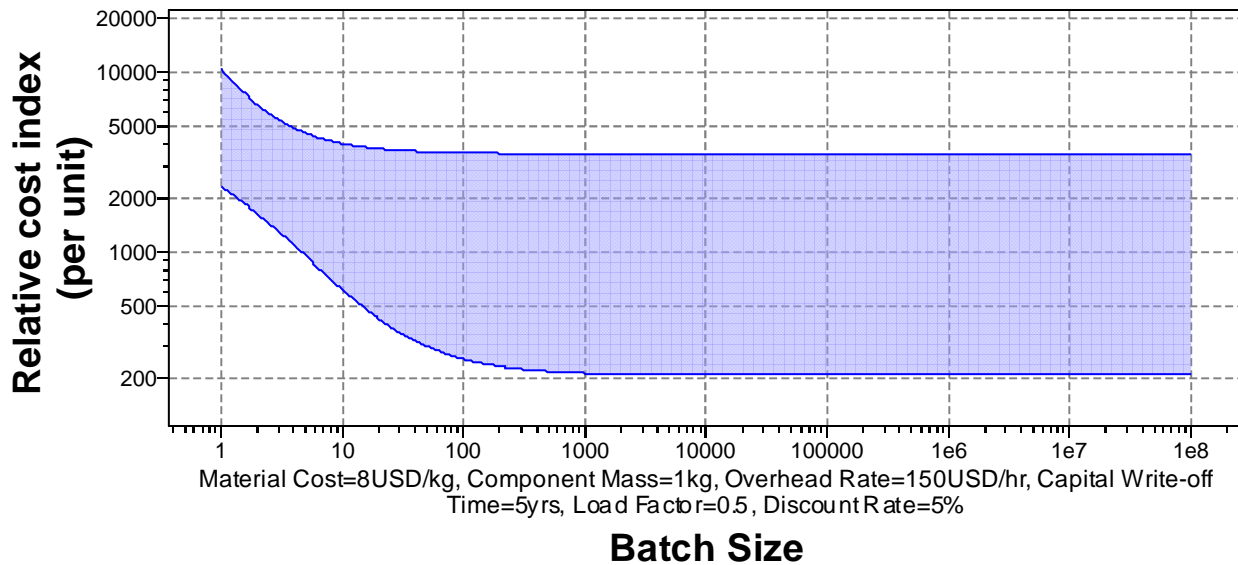
Process characteristics

Primary shaping processes	✓
Discrete	✓
Continuous	✗
Prototyping	✗

Cost model and defaults

Relative cost index (per unit)	211 - 3.53e3
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[Parameters:](#) Material Cost = 8USD/kg, Component Mass = 1kg, Batch Size = 1e3, Overhead Rate = 150USD/hr, Discount Rate = 5%, Capital Write-off Time = 5yrs, Load Factor = 0.5



Capital cost	6.56e4	-	8.2e5	USD
Material utilization fraction	0.8	-	0.95	
Production rate (units)	0.05	-	1	/hr
Tooling cost	820	-	8.2e3	USD
Tool life (units)	100	-	500	

Supporting information

Design guidelines

autoclave molding is limited to simple shapes with high surface area-to-thickness ratios. Ribs and bosses are possible but undercuts, inserts and foam panels should be avoided.

Technical notes

The reinforcement, typically, is glass (25-60%), carbon or aramid. Liquid polyester epoxy resins are sometimes used; but prepreg - epoxy, phenolic or polyimide are perhaps more usual.

Typical uses

Autoclave molding is, at present almost exclusively used for aircraft and aerospace components.

The economics

Tooling costs are low, and the process is not particularly labor intensive, making it attractive

The environment

Provision must be made for the efficient extraction of solvent

Links

MaterialUniverse

Reference