

Forming Technology Reaction Injection Molding

Reaction injection molding (RIM) includes cold cure foam molding. Both processes are used to shape thermosetting foam by injecting thermosetting polyurethane resin (PUR) into a mold, where it reacts to form a foamed or solid part.

Code:	Typical applications:	Advantages:
<ul style="list-style-type: none"> • Cold cure foam molding • Hot cure foam molding 	<ul style="list-style-type: none"> • Complex • Flexible • Large part volume 	<ul style="list-style-type: none"> • Good surface finish
Code:	Other processes:	Notes:
<ul style="list-style-type: none"> • Hot cure foam molding • Hot cure foam molding 	<ul style="list-style-type: none"> • Cold curing • Hot curing • Hot curing 	<ul style="list-style-type: none"> • Good surface finish • Good surface finish

INTRODUCTION
There are two processes used to create foams: Cold cure foam molding is generally attributed to molding hot foam for upholstery and sports equipment, whereas RIM covers molding all types of RIM including foam. In both processes, the density and structure of RIM are chosen to suit the application.

As well as low modulus and high volume production, this process is commonly used to produce parts that will be injection molded (see 30) because the foaming is much less expensive than for injection molding, while repeatability and accuracy are high.

TYPICAL APPLICATIONS
Popular uses include domestic and commercial furniture such as chairs, car seats and airplane seats, armrests and cushions. These processes are also suitable for cushioning functions in footwear, such as in the soles, and for safety and flexibility in toys.

RIM is chosen a great deal in the automotive industry for products such as bumpers, under bonnet applications and car interiors. It is utilized in the medical and aerospace industries for niche products and low volume production runs, too.

RELATED PROCESSES
Bulk foam geometries are also formed by CNC machining (page 48) or foam fabrication. The technique is often utilized to cover wooden structures in upholstery (page 34). Foam molding is becoming more widely used, for example, in the production of furniture and car seats – new formulations of PUR foam producing lower temperatures, so they are therefore less toxic.

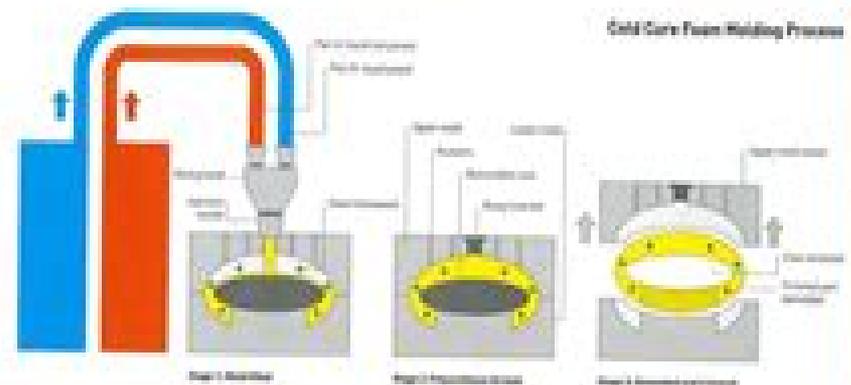
Vacuum casting (page 47) is used to form similar geometries in PUR, but is typically applied to smaller and more complex shapes. Vacuum casting and RIM are chosen to prototype and manufacture low volume. The



properties of the part are similar to injection molding.

QUALITY
The quality of the surface finish is determined by the surface of the mold. The coating can be produced in glass reinforced plastic (GRP), steel or alloyed steel. Even though this is a low pressure process, the liquid PUR reproduces the surface texture and details very well.

DESIGN OPPORTUNITIES
This is an extremely versatile process as the mechanical properties of the cured PUR can be designed to suit the application. The flexibility of foam can range from semi-rigid to very rigid, and the density can be adjusted from 0.1 g/cm³ to 1.2 g/cm³ (1.25 to 1.45). The outer skin and inner foam can have contrasting properties to form parts with a rigid skin and lightweight foam core, for example. RIM is similar to injection molding parts can be textured and the surface



TECHNICAL DESCRIPTION
In stage 1, the moulds are cleaned and a release agent is applied. Inserts and frames are then put into place and the mold is clamped shut. The 2 ingredients that react to form PUR are placed in separate containers. The paper seal prevents air from the mixing head, where they are combined at high pressure. The accelerated expansion of liquid chemicals are dispersed into the mold at a low pressure. As they are mixed they begin to go through a chemical exothermic reaction to create PUR.
During stage 2 the polymer begins to expand to fill the mold. The only pressure on the mold is from the expanding liquid, so molds have to be designed and fitted to ensure even spread of the polymer when it is still in its liquid state. As the polymer expands the pressure within increases so to ensure it does not rupture in the gaps to maintain internal pressure in the mold.
In stage 3, the product is demoulded after 5-10 minutes. The part cycle times vary according to the size and complexity of the part. The upper and lower surfaces of the mold are separated and the cores are removed. The mold is then cleaned and prepared for the next cycle.



Notes:
• Environmentally friendly and recyclable
• Recyclable and lightweight
• Good surface finish



Notes:
• The process is highly repeatable
• Good surface finish
• Good surface finish

Manufacturing Processes For Design Professionals

JA Banks



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Table of Contents Manufacturing Processes For Design Professionals

1. Understanding the eBook Manufacturing Processes For Design Professionals
 - The Rise of Digital Reading Manufacturing Processes For Design Professionals
 - Advantages of eBooks Over Traditional Books
2. Identifying Manufacturing Processes For Design Professionals
 - Exploring Different Genres
 - Considering Fiction vs. Non-Fiction
 - Determining Your Reading Goals
3. Choosing the Right eBook Platform
 - Popular eBook Platforms
 - Features to Look for in an Manufacturing Processes For Design Professionals
 - User-Friendly Interface
4. Exploring eBook Recommendations from Manufacturing Processes For Design Professionals

- Personalized Recommendations
 - Manufacturing Processes For Design Professionals User Reviews and Ratings
 - Manufacturing Processes For Design Professionals and Bestseller Lists
5. Accessing Manufacturing Processes For Design Professionals Free and Paid eBooks
 - Manufacturing Processes For Design Professionals Public Domain eBooks
 - Manufacturing Processes For Design Professionals eBook Subscription Services
 - Manufacturing Processes For Design Professionals Budget-Friendly Options
 6. Navigating Manufacturing Processes For Design Professionals eBook Formats
 - ePub, PDF, MOBI, and More
 - Manufacturing Processes For Design Professionals Compatibility with Devices
 - Manufacturing Processes For Design Professionals Enhanced eBook Features
 7. Enhancing Your Reading Experience
 - Adjustable Fonts and Text Sizes of Manufacturing Processes For Design Professionals
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 - Interactive Elements Manufacturing Processes For Design Professionals
 8. Staying Engaged with Manufacturing Processes For Design Professionals
 - Joining Online Reading Communities
 - Participating in Virtual Book Clubs
 - Following Authors and Publishers Manufacturing Processes For Design Professionals
 9. Balancing eBooks and Physical Books Manufacturing Processes For Design Professionals
 - Benefits of a Digital Library
 - Creating a Diverse Reading Collection Manufacturing Processes For Design Professionals
 10. Overcoming Reading Challenges
 - Dealing with Digital Eye Strain
 - Minimizing Distractions
 - Managing Screen Time
 11. Cultivating a Reading Routine Manufacturing Processes For Design Professionals
 - Setting Reading Goals Manufacturing Processes For Design Professionals
 - Carving Out Dedicated Reading Time
 12. Sourcing Reliable Information of Manufacturing Processes For Design Professionals

- Fact-Checking eBook Content of Manufacturing Processes For Design Professionals
 - Distinguishing Credible Sources
13. Promoting Lifelong Learning
- Utilizing eBooks for Skill Development
 - Exploring Educational eBooks
14. Embracing eBook Trends
- Integration of Multimedia Elements
 - Interactive and Gamified eBooks

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