

# Closed Mould Processing

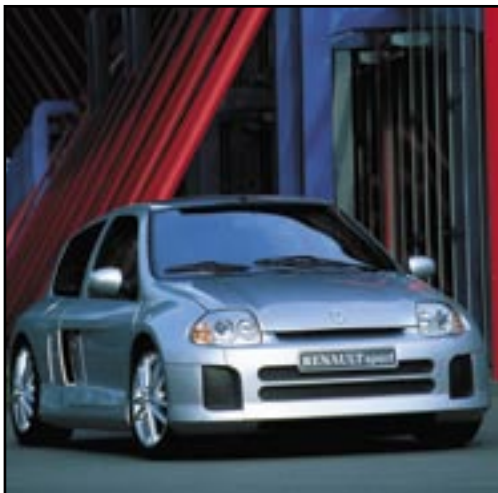
## Introduction

Open mould processing, by hand or spray lay up, is an established and adaptable method of manufacturing composite components of all shapes, sizes and complexity for relatively little capital investment. However, increasing commercial and environmental pressures are driving manufacturers to adopt alternatives to open moulding. The main drivers are:

- Improved Product Quality
- Improved Product Consistency
- Improved Productivity
- Reduced VOC Emissions\*
- Reduced Labour Costs

All of the closed mould processes described here require different operating procedures. With closed moulding, the emphasis is shifted from requiring highly skilled labour to achieve quality parts, to having the technology and procedures which ensure that quality and consistency are the inevitable outcome of the process.

In order to be successful, capital investment will be required and materials of higher cost than those used in contact moulding may be necessary. However, these costs can be more than offset by savings in labour, increases in productivity and better utilisation of factory space, leading to lower unit cost. More importantly, customer satisfaction should improve as a result of fewer rejects and the on-benefits to them of a consistent, product quality supply.



## Further Information and Technical Advice

For further information on all Scott Bader Crystic® resins and ancillary products or advice on how closed mould processing may improve the efficiency of your moulding operation, please contact our Technical Service Department, your Regional Sales Representative, or email: [composites@scottbader.com](mailto:composites@scottbader.com)

\*Reduced Volatile Organic Compound (VOC) emissions

## Closed Mould Processes Available

Four closed mould processes are currently available, covering a range of needs from relatively low volume production low capital cost, through to the efficiency of Resin Transfer Moulding (RTM). Scott Bader is dedicated to the continued development of closed mould processing and we are able to provide expertise and a range of Crystic® polyester products for the following techniques:

- **Vacuum Injection** : A simple, adaptable process, which uses a flexible film and traditional Fibre Reinforced Plastics (FRP) moulds. Suitable for making prototypes or 1-2 components per day.
- **VacFlo** : A cost effective entry into closed mould processing. The utilisation of lightweight, matched, FRP tools requires only low capital investment. Suitable for making up to 5 components per day.
- **RTM Light** : An extension of the VacFlo process, using similar mould design principles. The use of an injection machine to introduce resin into the mould further controls the process. Suitable for making up to 8 components per day.
- **Resin Transfer Moulding (RTM)** : A fast and efficient way of producing FRP parts. The process involves the controlled injection of resin through dry reinforcement placed in a rigid, matched, temperature controlled, composite or metal tool. Suitable for making up to 40 components per day.

The process adopted and productivity achieved will depend upon several factors, including the number of parts needed, unit cost, part size, complexity, specification, and the finance available for new equipment.

## The Importance of Tooling

Tooling design and materials will vary according to the process adopted and the quality required from the component part. Unlike conventional contact moulding, tooling for a closed mould process can be difficult and expensive to modify in order to accommodate changes in component design. It is therefore critical that the following parameters are agreed before committing to tooling production:

- Total number of parts and productivity rate required.
- Component shape and specification.
- The optimum process and materials to be used.
- Requirements for cavity tolerances and tool surface quality.
- Tool stiffness and weight, tool handling and closing mechanisms.
- Control mechanisms, such as built-in instrumentation and temperature control.
- Timescale, deadlines and unit cost.

## Crystic Resins for Closed Mould Processing

Scott Bader has developed a comprehensive range of unsaturated polyester resins suitable for closed mould processing. These resins all have low viscosity to enable excellent resin flow through the mould. The air release and fibre-wetting additives incorporated into their formulation, also aid the production of high quality laminates. The cure characteristics of these resins are specific to particular processes and applications, allowing all the advantages of closed mould processing to be realised. In addition to this standard range for closed mould processing, Scott Bader can develop a resin tailored to meet specific customer requirements, such as process parameters, physical properties, fire resistance or surface finish.



Crystic Resin	Type	Application
701PAX	Isophthalic	Vacuum Injection
702PAX	Orthophthalic	Vacuum Injection
705PA	Orthophthalic	Vacflo / RTM light
U963LVK	DCPD Modified	Vacflo / RTM Light
781PALV	Orthophthalic	RTM Light / RTM
783PA	Isophthalic	Vacflo / RTM Light / RTM
797PA	Isophthalic - Het acid - Filled fire retardant Antimony free BS. 476 Part 7 Class 1	Vacflo / RTM Light / RTM
U904LVK	Orthophthalic	VI / Vacflo / RTM Light / RTM
781PA	Orthophthalic	RTM
785PA	DCPD Modified	RTM Light / RTM
784PA	Filled Orthophthalic	RTM
790	Orthophthalic - Low profile	RTM
799PA	Orthophthalic - Filled fire retardant Halogen and Antimony free B.S.476 Part 7 Class 2	RTM

Other Crystic products are available on request.

## Ancillary Products for Closed Mould Processing

To achieve success in closed mould processing, it is important that all materials used are appropriate to the chosen process and are compatible with each other. Scott Bader has worked closely with leading suppliers to assemble a range of ancillary products that meet these criteria.

### Catalysts

An MEKP catalyst such as Butanox® M50 can be used in closed mould processing and may be the most appropriate choice for many applications. However, the use of other catalyst types may be advantageous. An AAP catalyst such as Trigonox® 44B, for example, can accelerate cure, thus improving productivity. Blended peroxides can be used to achieve a balance of cure characteristics.



### Reinforcements

Stitched and combination materials are increasingly used, since conventional reinforcements such as chopped strand mat are not generally suitable. Scott Bader distributes a range of stitched, woven, multi-axial or combination reinforcements from Chomarar. This range includes Rovicore®, a reinforcement which consists of glass fibres stitched either side of a non-woven, synthetic core, specially designed for use in closed mould processing.

The unique structure of Chomarar Rovicore gives it many advantages.



Les Fils d'Auguste CHOMARAT et Cie

### Release Agents

Conventional wax release agents will work in closed mould processing but the frequent re-application necessary means that optimum productivity is not achieved. Scott Bader distributes the complete range of Henkel - Loctite Frekote® semi-permanent release agents for rapid, easy application and multiple releases.



### Core Materials

Core materials, such as balsa wood and various types of foams, can be successfully included in all closed mould processes. Closed moulding is an ideal way to make composite sandwich constructions. Scott Bader distributes an extensive range of Airex structural, semi-structural and fire retardant foam cores. In the UK, Scott Bader also distributes the range of Baltek end grain balsa products for marine, transportation and industrial applications.



## Accessories for Vacuum Injection, VacFlo and RTM Light

After extensive trials, Scott Bader has assembled a range of accessories necessary for obtaining successful results in closed mould processes. Vacuum Injection ancillaries have been specifically chosen to streamline the process and reduce the number of disposable items required. A range of seals and quick fit inserts, which simplify mould construction, have been specially selected for use in VacFlo and RTM Light processes.

# Scott Bader Composites Europe

## HEAD OFFICE

### Scott Bader Company Limited

Wollaston  
England  
Tel: +44 1933 663100  
Fax: +44 1933 666139  
email: [composites@scottbader.com](mailto:composites@scottbader.com)

### Scott Bader SA

Amiens  
France  
Tel: +33 3 22 66 27 66  
Fax: +33 3 22 66 27 80  
email: [composites@scottbader.fr](mailto:composites@scottbader.fr)

### Scott Bader Scandinavia AB

Falkenberg  
Sweden  
Tel: +46 346 10100  
Fax: +46 346 59226  
email: [composites@scottbader.se](mailto:composites@scottbader.se)

### Scott Bader Eastern Europe

Liberec  
Czech Republic  
Tel: +420 48 5228 344/5111 255  
Fax: +420 48 5228 345/5111 254  
email: [composites@scottbader.cz](mailto:composites@scottbader.cz)

### Scott Bader Iberica

Barcelona  
Spain  
Tel: +34 93 553 1162  
Fax: +34 93 553 1163  
email: [composites@scottbader.es](mailto:composites@scottbader.es)

### Scott Bader S.A.

Zur Drehscheibe 5  
D - 92637 Weiden  
Germany  
Tel: +49 961 401 84474  
Fax: +49 961 401 84476  
email: [composites@scottbader.de](mailto:composites@scottbader.de)

### Chromos Tvornica Smola DD

10 000 Zagreb  
Zitnjak BB  
Croatia  
Tel: +385 1 240 6440  
Fax: +385 1 240 4573  
email: [cts@chromos-cts.hr](mailto:cts@chromos-cts.hr)

# Scott Bader Group Companies

### Scott Bader Inc

Stow, OH  
USA  
Tel: +1 330 920 4410  
Fax: +1 330 920 4415  
email: [info@scottbaderinc.com](mailto:info@scottbaderinc.com)

### Scott Bader (Pty) Limited

Hammarsdale  
Republic of South Africa  
Tel: +27 31 736 8500  
Fax: +27 31 736 8511  
email: [composites@scottbader.co.za](mailto:composites@scottbader.co.za)

### Scott Bader Middle East Limited

Jebel Ali  
Dubai  
Tel: +971 488 35025  
Fax: +971 488 35319  
email: [info@scottbader.co.ae](mailto:info@scottbader.co.ae)

### Scott Bader L.L.C.

P O Box 261970  
Dubai Investment Park  
Dubai  
Tel: +971 488 53121  
Fax: +971 488 32030  
email: [info@scottbader.co.ae](mailto:info@scottbader.co.ae)



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