FAILURES WITHIN ROTOMOULDING - Part 2

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This is the second article in our series of top ten reasons for failures within rotomoulding. In the previous article we discussed problems related to: swirling, venting & wrong material choice.

We will in this article concentrate on problems we see as number 5, 6 and 7 on our list.

7. Notch sensitivity.

Polyethylene is very sensitive to notch. This requires special attention when demoulding and trimming products. Products having inward corners and products where other parts will be mounted on to the end products need special attention.

The rotomoulding process normally implies trimming of the products. Excess material has to be removed in order to have an esthetical nice product. Normally a sharp knife will be used. Special attention to avoid notches in the product has to be taken, because notches can be starting point for failures. Air bubbles occurring in the parting line, can also be starting points for failures.

This is illustrated in images 1 and 2.

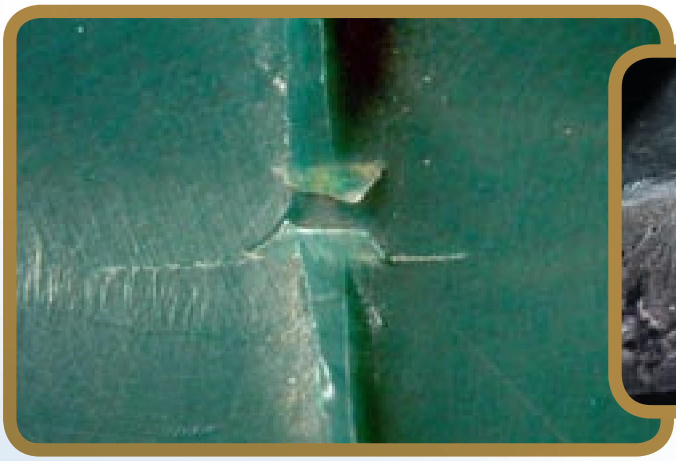
Problem solving:

It is very important to observe and maintain parting lines. If it is a bad parting line, material will come out between the two halves, hence, more difficult to trim the products. The knife can make a notch and notches have to be avoided. Do not use Stanley knives or other sharp knives. Special equipment for removing excess material is available in tooling shops.

Avoid sharp edges when mounting spare parts on products, which can make notches in the product during movements or loading when in service.

6. Design.

Even if many of the plastic materials seem to be more costly compared to traditional materials, they are ranked higher when it comes to total cost - from the raw material to the finished product. Therefore plastics are today established as one of the most cost effective and high performance products. When adding attractive properties as chemical resistance, toughness, endurance and not to mention processing of complex parts, there will be no doubt the usage of plastics will continue to increase. To maintain the increase, it is very important to have well proven procedures for design.



^ Image 1

^ Image 2

∧ Image 3

< Image 4

∨ Image 5

In general, the mechanical properties for plastics are defined as for metals and the procedures for designing therefore are the same. However, it is important to be aware of the differences.

The attached images 3, 4 & 5 show a problem occurring due to wrong design.

Due to the design, bridging has occurred in parts of the product. This is not favorable, because it can lead to weaknesses in the product. Hence, failures taking place when in service.

We will not go in depth how to design for rotomoulding. It is easy to get access to literature which describes the design process.

However, we have seen several products which have been a direct copy of the same product made out of other materials. Sometimes this can work, but in most cases the design has to be changed in order to protect the properties of the plastic. Here are some important ones:

Stiffness:

One of the advantages of rotomoulding is that we can produce products having thin walls relatively to the size of the product.

Introducing ribs and kiss-offs are important to achieve higher stiffness in rotomoulded products, especially when using plastic materials with relatively low stiffness and strength e.g. PE.

This secures a good product that can support extra loads and enhance the stiffness.

Corner radii:

A rotomoulded product will have a tendency to stress concentration in corners. Sharp corners will strengthen this. By introducing radii's, we will get smoother corners. Hence, better flow and more even thickness. The stress will be distributed over a bigger area and the result will be a tougher product.

The corner radii should be as big as possible without limiting products requirements. Compromises possibly have to be done and have to be considered in connection to the area of use, geometry and type of stress on the end product.

Tolerances:

It is difficult to give exact numbers for tolerances, because it is depending of the type of material used, the design, the mould and the processing method.

Normally, small articles will be better in tolerances compared to big articles. Thin products are better than thick products. Materials with high level of shrinkage are more difficult to produce to accurate tolerances compared to materials with low shrinkage level. Calculated tolerances therefore need to take into account the differences. Be aware a change in the heating- cooling cycle, pigments and release agent can change the size of the product.

5. Material distribution.

The most important when designing a plastic product is to keep even wall thickness. The rotomoulding process is unique, because the process it self creates relatively even material distribution despite of the specification from the designer. Still it can be difficult to control the wall thickness. That is why normally the tolerances are relatively high, 10 – 20%.

The material distribution can be influenced by changing the rotation speed and ratio. Another important thing that can influence the material distribution is how the mould is mounted on the arm. We have to secure no parts of the mould are shielded. The geometry of a mould can prevent the heat getting access to parts of the mould and the design is therefore very important when it comes to wall thickness distribution. The powder quality can influence the material flowing into intricate shapes of the product.

The attached image is illustrating what kind of material distribution we have seen in rotomoulded products. With such big differences, it is quite obvious this will influence the stress in a product and remember, products will never be stronger than the weakest point. In addition, uneven material distribution can result in problems related to warpage and dimensions of the final part. See image 6.

Problem solving:

Alter the rotation speed and ratio in order to secure that all parts of the mould surface have equal access to the powder pool. It can also be necessary to re-position the mould to avoid shielding. Poor flow characteristics of the powder may prevent it from gaining access to problem areas. Check dry flow behavior of your resin against specification and secure optimum air flow in the oven.

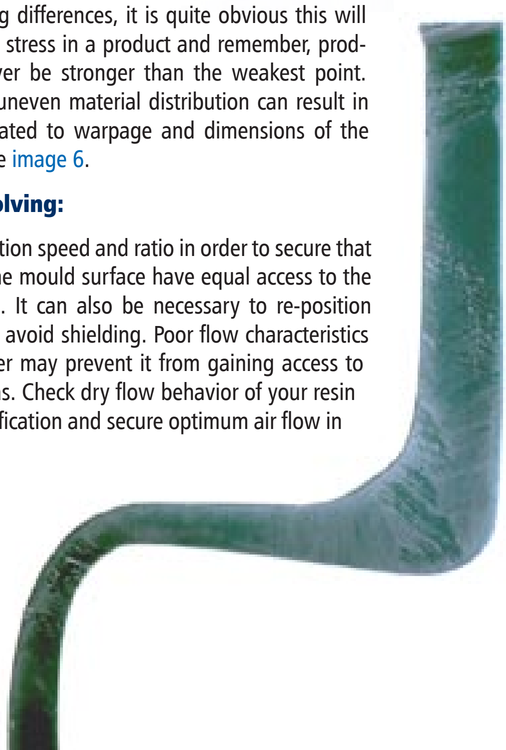


Image 6 >