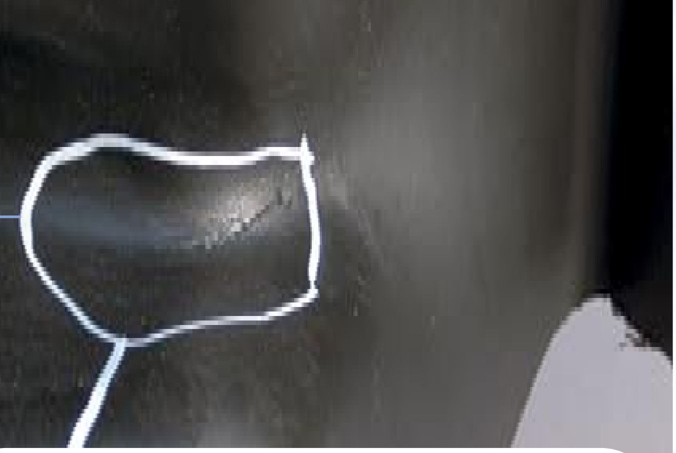

FAILURES WITHIN ROTOMOULDING - Part 1

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During our 20 years of experience within the Rotomoulding field we have been facing a lot of problems. Even if the machines, materials and operators are getting better and better, problems will still occur. At the same time the requirements and demands of the end product are increasing. This will be challenging for us working within this industry.

The problems we have been confronted with have various casualties and often they are composed of several problems. It can be problems related to production of the resin, compounding or pigmentation of the material, grinding of the material and last but not least, processing issues.

It will be different approach to the problems depending of who is making the inquiry:

The customer will blame the supplier.
The supplier will blame the customer, the pigment supplier or the grinder.

The investigating laboratory should act independently and try to find the question of cause.

Norner Innovation has long experience in examine problems within Rotomoulding. We also have broad background from other application techniques as injection moulding, blow moulding and extruding, and we hold major competence within many areas which involves plastic.

We see that rotomoulding still is struggling with problems that other processing techniques have solved many years ago. This is what we will try to improve and in this and coming articles we will put focus on these areas.

If we do not improve our quality mindset within our industry, we are afraid rotomoulding will loose ground to other applications.

Based on our experience we will highlight our top ten ranking of failures within rotmoulding and starts with number 10:

10. Swirling.

Swirling is defined to be darker stripes or area in a pigmented part.

Swirling is not caused by the pigment itself.

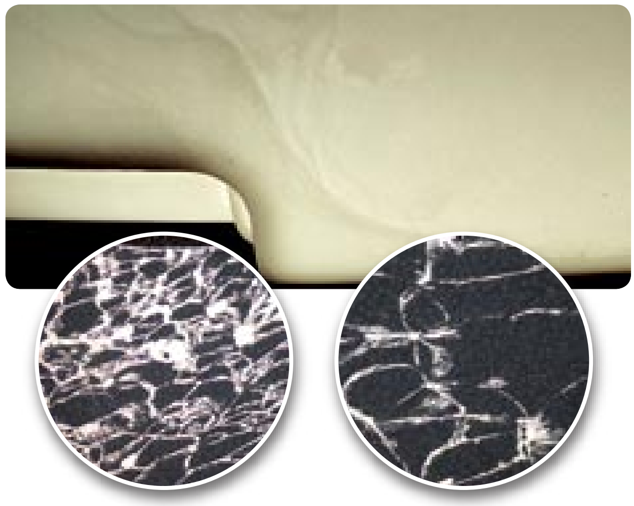
Nevertheless, the darker area contains more pigment than the adjacent areas. This is explained by, when doing the dry mixing of pigment into the natural material, there will be a static build up of the powder particles. Smaller particles will first be statically charged and relatively more pigment will adhere to these particles, because the pigment particles are smaller in size compared to the powder particles. When the rotomoulding process starts, the smaller particles immediately will attract to the mould surface, due to the static charge, and create these darker areas / stripes. That is also why the darker areas can move around, depending of the starting position of the arm.

Problem solving:

There are several ways to overcome the problem. Primarily the best option is to use a fully compounded material. However, this will have an implication on costs and it is therefore not always the preferred solution by rotomoulders.

Further more, antistatic agent can be added direct into the mould. In addition we have seen customers adding small amount of mineral oil or water, which sometimes can help solving the problem.

The Powder Size Distribution can be of importance and should be checked. Try to avoid too much fines in your powder. Check the specification with your supplier.



Area with stripes - particles with high content of pigment

Area without stripes - particles with normal content of pigment

Secure relatively high humidity level in the working environment.

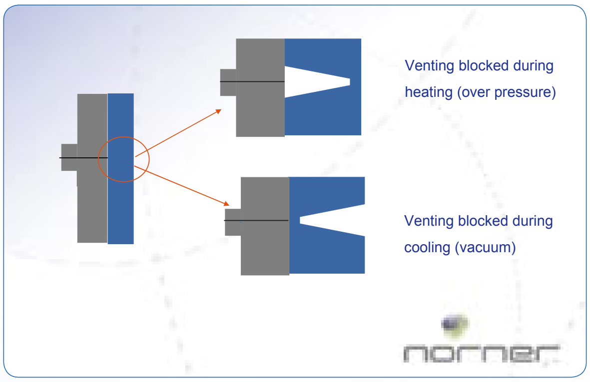
Static electricity is a well known problem in rotomoulding, both when doing dry mixing of pigment and processing of natural material. Additive suppliers are working to find new and better solutions to avoid static build up.

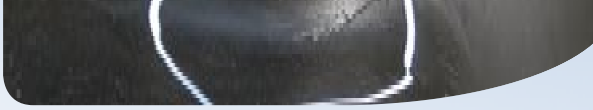
9. Mould / Venting issues.

The unusual feature of a mould for the rotomoulding process is the existence of a vent pipe from the interior to the exterior. In this way we ensure the inside mould always remains at atmospheric pressure. Otherwise problems can occur during both heating and cooling stage.

Heating:

If the vent pipe is blocked during the heating stage, there will be a build up of pressure inside the mould, because the internal air is prevented from expanding. This pressure can have a beneficial effect in consolidating the molten skin to the inside of the mould and secure effective sintering. However, it can also tend to force the plastic out at the parting line, creating bubbles at the outside of the product. Hence, failures can occur in this area.





Cooling:

If the vent pipe is blocked during the cooling stage, most likely there will be less air inside the mould, creating a vacuum. This would be sufficient to pull the part away from the mould wall and create a distorted product. Bubbles or pores can occur in the parting line at the inside of the product, resulting in weakening of the product.

Problem solving:

The vent pipe is most important when you have a product with large flat areas or a walled product.

Always secure the vent pipe is open and the size has to fit to the mould size. In addition it would be beneficial to place a Teflon tube with glass fiber or steel wool through the vent pipe to avoid polymer powder escaping from the mould and to keep the equilibrium of the pressure between inside and outside of the mould.

The parting line is in many ways the most important part of the mould. It must be strategically placed and flanges are placed in this area to facilitate clamping.

Keep a close eye to your parting line. Maintain and clean it frequently in order to prevent powder exiting during the heat cycle and water entering during cooling. At the same time you will secure to have a good quality part.

8. Wrong material selection.

The polyethylene materials used for rotational moulding are classified according to their density and Melt Flow Index. The density is defined as the weight for a given volume, while the Melt Flow Index is defined as the viscosity at a particular temperature. These parameters will influence on the moulding process and the properties of the end product, e.g. impact strength, stiffness and Environmental Stress crack resistance – ESCR.

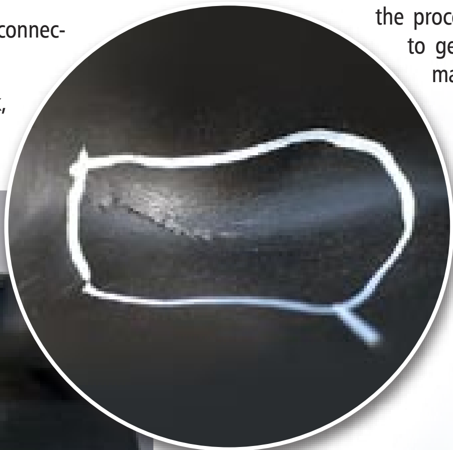
However, other properties are not influenced by the variations in density and MFI.

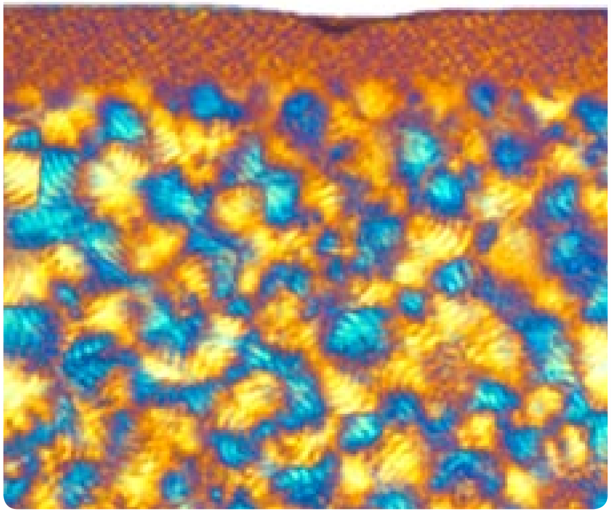
Increasing density will give increased stiffness to a product. Increasing MFI will give better flow properties in narrow sections, but normally lower physical properties. Therefore it will often be a compromise when selecting the right material.

New developments within materials have to a certain degree changed these facts. Materials with relatively high MFI can have good balance between properties.

Still we see the wrong material being selected in connection to the products application area.

The picture shows part of an 800 l automotive tank, which has a crack in a curvature. Investigations showed it was difficult to achieve good material distribution, and in addition it had bad sintering with bubbles in the same area. The tank was undergoing quality inspection by supplying low pressure to check for leakage. The customer changed to a material with higher MFI. This solved the problems related to material distribution and sintering, but new problems occurred. Now the tank broke, due to lower physical properties of the new material.





The next picture is a microscopic picture of a cross section of a product where details of the crystal structure can be seen.

During the cooling phase spherulites (crystals) will be created. The sizes of the spherulites are depending of which grade is being used and the cooling speed during the process.

However, in this case we can see that on the inside of the product the spherulites have started to change in size and shape. The change has happened due to degradation when in service.

Problem solving:

When choosing the optimum resin for a product, we need to know the end requirements. Is it stiffness, impact strength, flow properties or ESCR which is important? Very often we have to compromise. It can be the product needs very good impact strength and ESCR value, at the same time as good stiffness is needed. Probably we then have to look at the design in order to have an optimum product.

However, the most important thing we do is to optimize the processing conditions. In this way we secure to get the optimum properties of the chosen material.

To be continued