Comparison of Deflashing Methods

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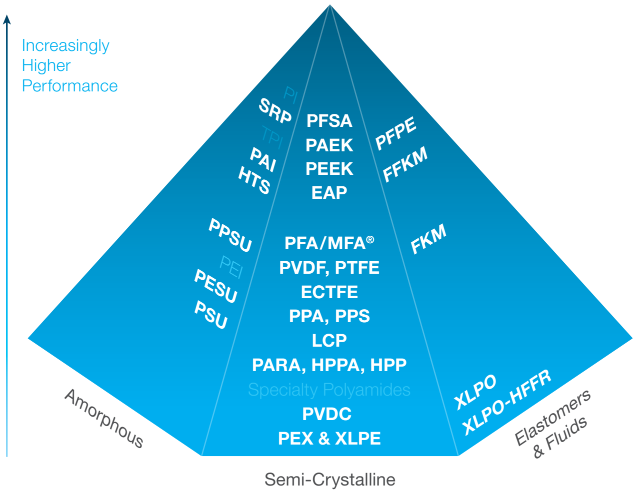
Solvay Specialty Polymers offers more high-performance polymers than any other company in the world. Our products cover a broad range of performance capabilities and are specifically engineered to address the challenges that design engineers face every day.

To complement our broad portfolio (see Figure 1), Solvay manages state-of-the-art technical service centers located around the world. Our knowledgeable and experienced Technical Marketing Team can provide in-depth technical assistance for global customer initiatives, from part design and material selection to product testing and commercial production.

Figure 1: Solvay offers over 35 different families of high-performance polymers



Flash on Molded Components

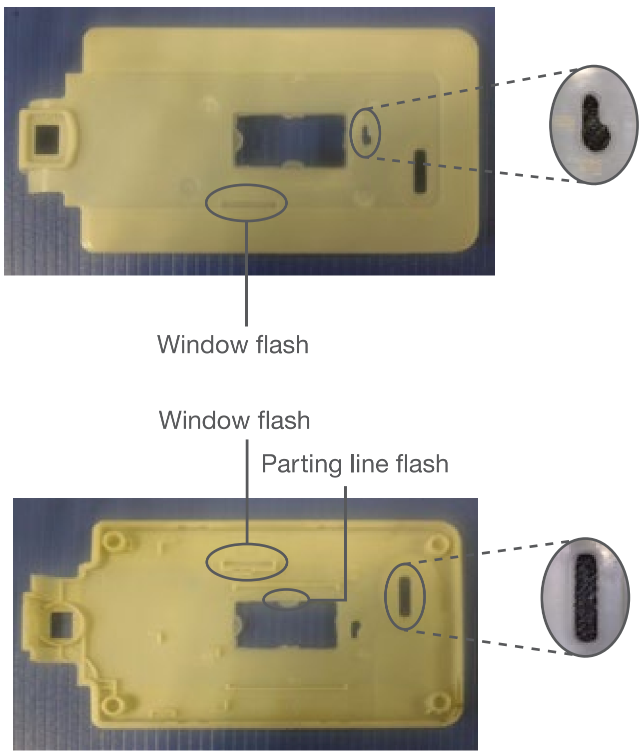
On parts molded from plastics, end-users occasionally encounter the presence of flash left in the space between mold cavity edges, otherwise known as the parting line. This space or parting line can be caused due to part complexity (many mating surfaces), old mold cavities that no longer fit together tightly, stresses generated in the tool in operation (thermal, mechanical, etc.) or wear of the tool.

The scope of this document is to present some deflashing methods (description, advantages, disadvantages and a general cost comparison) as well as tests performed on a real molded part. Most of these technologies are well known in the field of metallurgy because flash is very common on molded or cast metal parts and needs to be removed.

Testing Procedure

The test specimen shown in Figure 2 depicts a typical component where deflashing is present. This type of component was selected as it contains a variety of flash examples, including window flash and a parting line. A series of parts were deflashed via each of the methods described in this document in order to evaluate the efficiency of each type of deflashing technology.

Figure 2: Front and back of test specimen



Deflashing Methods

The methods detailed here are processes that Solvay has used to remove flash on molded components. The industry uses many different processes, such as tumbling and/or blasting based on dry or wet abrasives or mechanical load combined with cryogenic methods and manual cutting or machining methods using knives, scrapers and robots.

Manual operations using knives and scrapers are quite straightforward to understand; however, they are time consuming and generally not cost-effective for large volumes of parts. These techniques are not evaluated here.

The main methods investigated using the test specimen described are as follows:

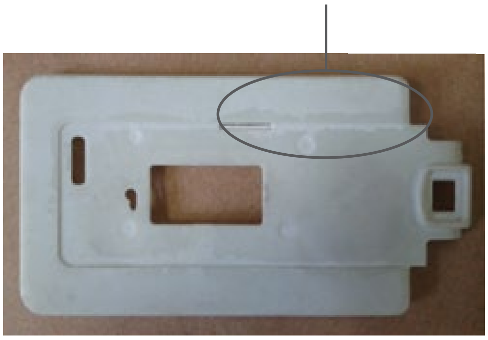
- Thermal energy deflashing
- Magnetic abrasive deflashing
- Blast deflashing
- Ultrasonic vibration deflashing
- Cryogenic deflashing system

For each method, a short description of the method is provided along with a picture of the deflashing results, suitability, batch size estimation, advantages and disadvantages as well as cost estimation.

Thermal Energy Deflashing

Thermal energy deflashing uses transient burning of the mixture of O_2 and H_2 (or O_2 and CH_4) to burn out flash. The burning time is very fast, up to 0.003 seconds or less. The combustion temperature can reach as high as 3,000 °C (5,432 °F).

Figure 3: Specimen deflashed by thermal energy



Suitability

The method is good for metal components. For plastic and rubber components, it will burn part surfaces and cause rough aesthetics that may not be acceptable to parts requiring a high-quality surface appearance.

Advantage

The cycle time of thermal energy deflashing is relatively quick, which suits mass production. The deflashing effect is quite good.

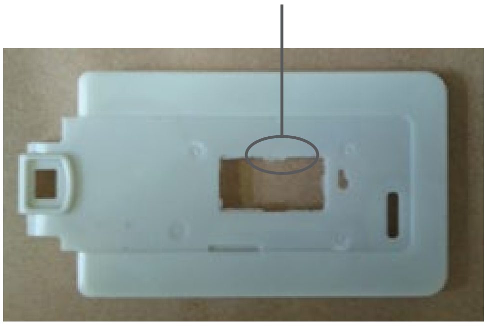
Disadvantage

The burning temperature is very high and the plastic component can be burned on all surfaces. The appearance surface of the part will be adversely affected, so this method can't be used for parts with a high-quality surface requirement.

Magnetic Abrasive Deflashing

This method is one of the pellet abrasive techniques used to deflash a part. Hundreds, even thousands, of tiny steel pins mixed with water and driven by a magnetic force will rotate with water at high speed. The steel pins abrade the part surface and the flash area is removed.

Figure 4: Specimen deflashed by magnetic abrasion



Suitability

This method is effective for parts that are produced from a relatively low elongation material (< 2 %); however, it does not have a good deflashing effect for tough, flexible materials. This method is proper for metal parts, even with shallow and deep holes.

Advantage

The deflashing time per batch is about two to three minutes. Each batch can contain up to 30 pieces. The steel pins suffer very little abrasion and can be reused.

Disadvantage

The deflashing effect is not good for plastic and rubber components because of the "softness" of the flash.

Blast Deflashing

Blast deflashing is a traditional way to deflash metal pieces. The blasting equipment sprays metal powder (usually alumina) on the part surface using high pressure and speed. The metal powder abrades flash away from parts and can rough up the part surface owing to powder abrasion.

Figure 5: Specimen deflashed by blasting spray

Suitability

This method can be used for all materials and parts with a low surface appearance requirement because the deflashing process produces a rough surface.

Advantage

The deflashing equipment can be designed for an automatic line with a transport belt. It also can be used as a manual spray gun. The flexibility of this method makes it suitable for mass production and small handling. The blasting equipment is not expensive and the metal powder can be recycled.

Disadvantage

The method is not suitable for parts with a high aesthetic surface requirement due to its strong abrasion of the part surface.

Ultrasonic Vibration Deflashing

Ultrasonic vibration deflashing comes from ultrasonic cleaning technology. The ultrasonic energy generated by an ultrasonic generator is transmitted to mechanical energy that forces water into a very high vibration mode that, in turn, deflashes the part. The power of an ultrasonic generator can be up to 7200 W. The temperature of cold water used for deflashing is about 6 °C (43 °F). The deflashing time is about three to five minutes per batch.

Figure 6: Specimen deflashed by ultrasonic vibration

Suitability

The ultrasonic vibration method is suitable for metal as well as plastic components. It is not appropriate for rubber material because of the material's toughness.

Advantage

The deflashing equipment can hold up to 40 pieces per batch so it can be used for mass production. The deflashing effect for plastic materials shows good deflashing results without damaging the part surface.

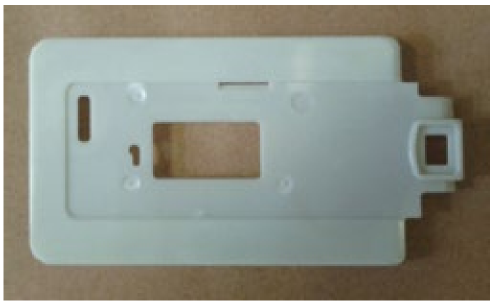
Disadvantage

This method can meet the deflashing requirement of plastic (except rubber) and metal components.

Cryogenic Deflashing System (CDS)

A cryogenic method uses liquid nitrogen to cool the part quickly to about - 40 °C (- 40 °F), causing thin flash areas to become more brittle than the rest of the part. These brittle areas break off under the subsequent mechanical solicitation caused by spraying PC particles to remove flash. Special attention needs to be paid to thin-wall applications when using a cryogenic method because the thin areas can also become brittle.

Figure 7: Specimen deflashed by cryogenic deflashing



Suitability

This cryogenic deflashing method is acceptable for all kinds of materials, especially plastics and rubber. It is very effective without damaging the part surface.

Advantage

The deflashing system can contain up to 180 pieces per batch, making it well-suited for mass production. Deflashing time is about three minutes per batch. For plastic materials, it shows good deflashing results without damaging the part surface.

Disadvantage

The specimen easily absorbs moisture when it's removed from the equipment due to its very low surface temperature. For components with metal inserts, there is a high risk of damaging the surface due to scratching the metal insert. The cost of liquid nitrogen is fairly high compared to other deflashing method.

Cost Comparisons

Table 1 gives a cost comparison (relative investment costs and operating costs) for the different technologies described in this bulletin.

Table 1: Relative investment and operating costs

Technology	Relative Investment	Operating Costs
Thermal energy	30	H_2 & O_2 consumption
Magnetic abrasive	1	Abrasive powders (recyclable)
Blasting	5 to 10	Abrasive powders (recyclable)
Ultrasonic vibration	10 to 15	Filters, nylon masks
Cryogenic	20	Nitrogen consumption

Conclusions

Not all methods of deflashing technologies presented are well-suited for Solvay products. The following provides a comparison of the methods evaluated:

Thermal energy deflashing is an efficient and effective method to deflash parts but it has great risk of damaging the part surface. It is good for metal component deflashing. It may not be well-suited for plastic and rubber components, especially glass-fiber-filled grade polymers.

Magnetic abrasive deflashing is an economic method to deflash parts and is typically used for metal components. It is difficult to use this method for plastic and rubber materials due to its poor deflashing effect.

Blasting deflashing is an effective and efficient method for parts with low surface quality requirements. It can be used for all types of materials.

Ultrasonic vibration deflashing is an efficient and comparatively economic way to deflash. It can be used for metal and plastic parts that are not too soft.

Cryogenic deflashing method is quite good for rubber and plastic components with very good effect and efficiency. It is fairly expensive due to liquid nitrogen consumption.

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