SOLVAY
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Deflashing Components Molded From Solvay High-Perfomance Plastics

Solvay Specialty Polymers is a leading supplier of high-performance thermoplastics. Our products are available in a variety of formulations, including unreinforced, glass fiber reinforced, mineral/glass reinforced and compounded with elastomers to improve impact resistance.

Changes in polymer melt chemistry of resins formulated to provide exceptional surface appearance, high strength, rigidity, thermal resistance, dimensional stability and resistance to sterilization may be visible only during or after processing. These secondary attributes can affect processing and impose post-processing treatment.

The purpose of this document is to increase the level of awareness and knowledge of various issues attributed to flash and flash elimination. Included are the hows and whys and a basic review of the different technologies available to treat flash.

High-performance polymers exhibit wide differences in their visco-elastic behavior (how they flow when molten). Ixef® polyarylamide (PARA) contains high levels of glass fiber and develops a glossy surface due to its superior flow base resin. Alternatively, Amodel® polyphthalamide (PPA), not considered a “visual” product, responds more to a need for thermal resistance. Amodel® PPA resin, with it’s higher melt viscosity and lower flow, tends to flash less than Ixef® PARA resin. A resin’s tendency to produce parting flash may be attributed to two factors: the resin's chemical and processing characteristics.

Parting line flash occurs when resin leaks outside of the mating surfaces of the “fixed” and “movable” halves of the tool. There are many causes for flash, including:

- Resin melt viscosity
- Excessive wear of the tool steel at the parting line
- Inadequate clamp pressure of the molding machine
- Excessive injection speed
- Inadequate venting
- Polymer shear sensitivity
- Moisture

In many instances flash can be eliminated or reduced by changing processing conditions and/or rectification of tool steel. However, in instances where this is not practical, deflashing may be necessary. For more information on reducing flash, please contact your Solvay representative.

Deflashing Methods

A variety of deflashing systems exist that are suitable for components molded from Solvay products. There are four basic methods for deflashing molded parts:

- Blasting
- Mechanically (manually) with specially designed tools by an operator
- Tumbling
- Vibratory

Automated deflashing systems are supplied in batch and continuous process configurations. There is no general rule as to which method is best for Solvay's resins. The differences become more apparent when considerations such as visual surface quality, through-put and capital investment are evaluated. Each systems has its benefits.

There are many producers of deflashing systems. Each manufacturer has several types of technology available to accomplish basically the same function. Below is a brief description of a number of the methods available for deflashing. This list of technologies and manufacturers is not exhaustive. It is intended to give you an idea of what is available and basically how the technology works.

Blast Technology

This is the most common technique for deflashing thermoplastic parts. There are numerous ways in which blasting is used. What is common to all types of blasting methods is the use of a polymer (or in some very limited cases non-polymer) media to serve as an abrasive to impact and remove the flash area from the component.

In a blast system, parts to be treated are held on a belt, basket or other fixturing carriage and then passed through a blowing stream of media. The media strikes all of the part and the flash and removes the weaker portions of plastic in it's path. More advanced blast systems are available with precision nozzles that are directable to clean a narrower target zone. This latter system has the only disadvantage of not being system flexible; major modifications must be made to the system in order to adapt to differing part geometries.

Mechanical Deflashing

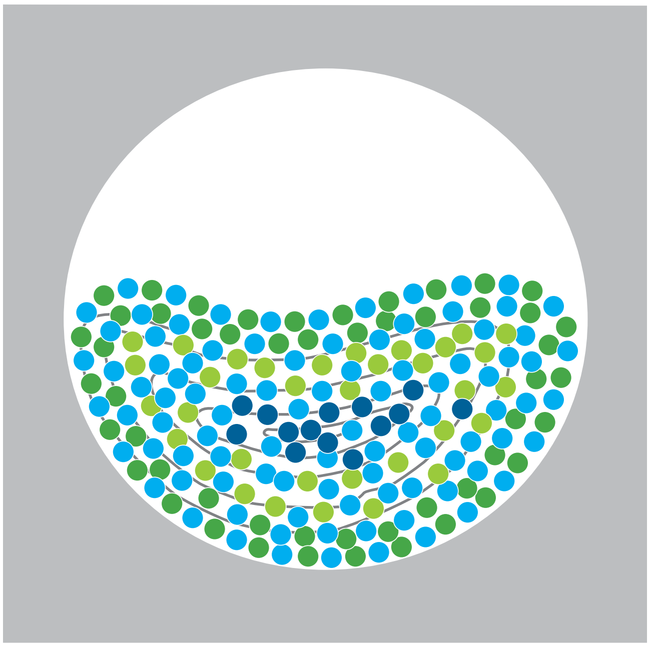
This labor intensive process utilizes an operator with specially designed tools to remove visible flash by hand. The advantage is that only areas requiring treatment are trimmed. The disadvantages are high cost of labor and limited capacities.

Tumbling

Of the automated equipment available, this is the simplest technology. Tumblers are composed of a cylindrical shaped device that is designed to rotate on a longitudinal axis. Plastic parts are placed inside and the cylinder is charged with an abrasive media that when rotated, passes over, thru and around parts as they "tumble" during rotation. This type of technology is used more frequently for grinding operations (such as low-temperature micronizing) and is of limited use for deflashing polymers. The disadvantage draws from the fact that only a limited form of flash can be removed efficiently. External parting line flash is a good example. Internal "window" flash is very difficult to remove using this method. A second disadvantage is surface defects caused by parts falling upon each other during rotation.

Figure 1 shows the basic principle of a tumbler. Here we see a cylindrical container filled with 12 or so molded parts (dark blue dots) to be deflashed surrounded by deflashing media depicted in green and light blue. As the drum turns the parts begin to rotate and the deflashing media tumble around them knocking off flash edges. The parts are then removed and blown off with compressed air to remove contamination, etc.

Figure 1: Basic tumbler design



Figures 2 and 3 show actual industrial sized tumblers installed. Figure 2 is an industrial sized tumbler (used for grinding rather than deflashing, the principles of operation are exactly the same). Figure 3 depicts a typical machine located at a press.

When making a decision concerning tumbling, consideration must be given to the nature of the flash desired to be removed (window flash, external parting line, etc.), the grade of resin, tumbling media and the surface aspect of any areas of the deflashed part which may be visible. Complications often arise due to the fact that "appearance" parts impact each other during tumbling and damage the surface, making them unacceptable visually. Tumblers are well-suited for non-appearance parts that have external parting line flash only. Tumblers cannot remove internal window flash. It is for all of these reasons that recommendations for tumbling are very limited for use with Ixef® PARA resins. Painted parts may be more forgiving with regard to surface defects caused during tumbling.

Figure 2: Industrial scale tumbler

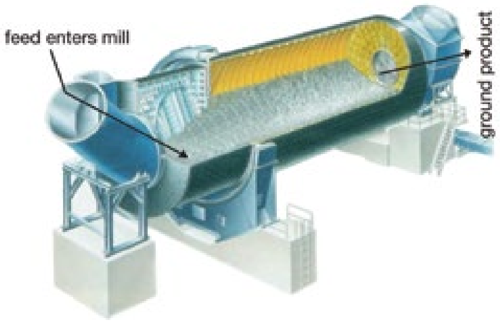


Figure 3: Shop floor scale tumbler

Vibration

The use of vibration technology to remove flash is the latest innovation in the world of deflashing. Vibration makes use of a large circular or drum-shaped chamber, equipped with a perforated deck or "floor", which permits circulation by vibration abrasive media in, through, around and under the part. Drum chamber and vibratory floor sizes vary according to the desired batch size. Vibratory deflashers, in most cases, are a batch style process. The disadvantages are similar to tumbling in that there are risks of surface defects as parts impact upon themselves, the vibratory deck or other parts. Parts that are to be painted would be less of a concern here. Due to the batch nature, handling rates may be somewhat slower than continuous process "blast" technology. However, because the media speed energy is lower, there is the advantage of less risk of surface defects than with other methods.

Deflashing System Components

This section discusses the different system components of blast style deflashers. Generally speaking there are five functional components within a deflashing station. Deflashing manufacturers differentiate their product by altering these functional groups.

Blast Media

Blast technology is defined as particulate or granulate that is propelled by compressed air, gravity, pumps or some other propulsion system impacting the flash. It works in the same way as sandblasting – a high-speed particle impacts a surface removing loose particles. Considerations must be taken concerning the hardness of the surface to be deflashed and the size of the media in use. A blast media that is harder than the polymer used to mold the part will damage the surface finish. Blast media is available in polypropylene, polycarbonate, polyamide, polystyrene, walnut shells, etc.

Specialised blast media are available with differing surface geometries: bead, pyramidic, hexagonal, etc. These variations in geometry are more effective at penetration into smaller "window" areas on parts. Providing that the media contains a surface hardness lower than the grade being deflashed, these variations may be worth considering.

More sophisticated deflashing processes make use of CO_2 (carbon dioxide) crystals. This type of technology is very expensive and was designed for deflashing thermoplastic and thermoset rubbers/elastomers. It has proven effective with a limited number of grades of Ixef® PARA and Amodel® PPA resins containing elastomer modifiers. The use of CO_2 with non-elastomer modified grades is not necessary as their high rigidity and low elongation lend them to the simpler blast style method. Carbon dioxide's effectiveness is due to the extreme low temperatures at which they function. CO_2 crystals lower the temperature of the flash zone thus increasing the stiffness of the flash to the point it is more brittle and thus easier to remove.

Transport Mechanism

This may be either a moving elastomeric or wire mesh belt, a metal/wire basket, or a purpose-built fixturing carriage on rollers which serves to hold pieces as they proceed through the media stream. Some deflashing stations are designed for the user to manipulate parts by hand through use of a glove box style cabinet. For large volume production and small parts, glove box handling is neither practical nor economical.

Of particular importance to the end-user concerning transport mechanisms is the air tightness of any moving parts that are equipped with roller bearings or other sealed lubricated connections. Dust production during operation of the deflashing unit is so prevalent that serious wear on critical moving parts is almost assured. Non dust-tight areas may allow the introduction of grease, oil or foreign matter contamination out of the flexible area and into the deflashing chamber.

Foreign matter contamination may hamper paint or decorative adhesion on the molded part after the part is deflashed. Additionally, it is particularly difficult to identify once it occurs (particularly amongst unsuspecting operators). On the other hand, non dust-tight fittings can also allow penetration of abrasive dust (glass fiber particulate) which will increase wear rates on moving parts. This is an additional source of cost and has an impact on the overall economics. Warranting consideration in the selection of transport equipment is the choice of steels and post manufacturing decoration. As many assemblies are fabricated from cold rolled low carbon steel, rust is a consideration for systems operating in non-controlled environments. It would seem the choice of stainless where possible would be beneficial to overall system cleanliness.

Media Projection

Blast stream, blast gun, blast wheel and vacuum assist are all methods for which the media is propelled from a source to the target. Each manufacturer has its own separate set of advantages and benefits to its projection technology. While each method certainly has its merits, of prime importance here is that the type selected must have a variable rate of delivery, either in pressure, volume or both. This is critical to being able to adapt the equipment to the surface hardness (and thus the ability to prevent surface damage) of the molded part.

De-Dusting, Dust Extraction or Anti-Static Systems

This refers to two different process steps which serve to accomplish similar cleaning functions. As deflashing utilizes a tremendous volume of air, it is necessary to vent excess air to the atmosphere. Dust extraction is required to prevent dust risks to the operator or work area in proximity. Anti-static systems serve the purpose of removing any static electricity from the deflashed part before it leaves the handling area. This will serve to reduce part contamination, which is particularly important if further over-molding steps are to be employed.

Media Cleaning

All equipment will require some form of maintenance to keep a machine operating in its optimum range. Cleaning of blast media and wear on the blast media by the equipment itself (as opposed to wear on the surface of the part to be deflashed) should be taken into consideration for maintenance and operating costs. Some equipment will be provided with automatic media cleansing. This is accomplished by either sieve filtration or a cyclone separation device. The latter operating by separating the different particle size due to differences in density (mass) of the blast media.

Systems Manufacturers

The suppliers listed below are some of the more well-known manufacturers at the time this document was written.

- www.maxiblast.com
- www.polyblast.com
- www.compomat.com
- www.hullindustries.com
- www.rosler.com
- www.leonardenterprises.com
- www.geringer.de
- www.cryogenicdeflashingsystems.com
- www.trowal.com

During evaluation of a new system, some factors to consider include:

- Batch or continuous process (volume dependent)
- Blast or vibratory method
- Variable blast energy
- System cleaning (media and the machine)
- Antistatic needs
- System maintenance cost

Most manufacturers are willing to give product demonstrations. This aspect should be a critical part to any purchasing decision.

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