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Maker of Specialty Chemicals for Injection Molders

Mold Releases: For Better or for Worse

What is a mold release and why do we need them, anyway?

When molding parts, there is a tendency for those parts to stick in the mold. This might be due to a mechanical situation like an undercut or it might be a chemical adhesion. The result is pretty much the same. The part doesn't come out freely and the operation is shut down while it is removed or the part comes out reluctantly and is damaged. Damages might be part deformation or a surface blemish. Neither of these situations is acceptable if the molder is determined to have a profitable operation. Even if the part hangs up and does not totally stick, the cycle time is upset which is also a financial loss.

There are two categories of mold releases, internal and external. An internal release is added to the resin and carefully compounded into it or added later by the molder and blended in. During molding the release "blooms" to the surface of the part and allows easy part removal. Generally, internal releases are custom fitted to the particular resin system. Most resin compounds do have an internal lubricant added to them but it may not suffice for easy part removal. Many factors are involved, as there must be no interference with other components of the resin formulation. This is a highly specialized field and I am not qualified to make more than this superficial comment.

An external mold release is a material that is applied to the mold surface prior to molding. Many of these releases are an "oily" material. When the part is ejected from the mold some of the release stays on the mold surface and some stays with the part. For this reason, releases are often called parting agents. Each time the release is "parted" there is less release remaining on the mold. At some point [usually in the range of four to ten parts] there is insufficient release and the sticking problem recurs. At that point, another application of release is required.

If you don't want to buy mold release, what are your options?

- Look for problems in parts and mold design **before** tooling is built. Design the part so that it comes out of the mold easily. Analyze shrinkage forces on cores and cavities, especially crystalline materials.
- Design the part so that it comes out of the mold easily. Avoid deep draws and provide adequate draft [1 degree or more depending on resin to be molded].
- Make the tool out of metals that have better lubricity or provide a coating that does that.
- Polish the tool to avoid micro undercuts that cause drag.
- Take care of the tool to avoid nicks and scratches. Use tools softer than the tool steel when removing a stuck part. [bronze or brass is often a good choice]
- Avoid deep mold textures [they may actually create an undercut if on vertical surfaces].
- Avoid rust and other corrosion. Use a good anti-rust material to protect the mold before storing [SLIDE Mold Shield, 42916T or NoRust, 40212]. Store molds in dry areas. If you are molding PVC or certain fire retardant resins, a special anti-rust material with extra acid neutralizing power is a plus [SLIDE Acid Vapor Neutralizer, 44016T]. In extreme cases, a mold release that

has a neutralizer in it is used where acidic fumes are created in molding [SLIDE Mold
- Saver Release, 42516T]. HCl may be released during PVC molding, for instance.
- Dry resins properly before molding. This is particularly important where acidic materials are present. Water increases corrosivity of mineral acids such as HCl. In fact HCL does not attack steel unless moisture is present.
- Select proper operating conditions. The temperature of the part at ejection time influences how well it releases.
- When molding soft parts such as elastomers, a vacuum may be formed as ejectors pins are pushing the part off the mold. An air injection to assist release works well. This should be considered at design stage, rather than as an after thought.
- Before a mold is ever shot with a resin, clean it thoroughly with a good degreaser [SLIDE Mold Cleaner Plus Degreaser III, 45920] and apply a semi-permanent release to fill the micro-porosities of the tool steel [Slide DuraKote Mold Release, 41716]. By filling these micropores with a release material instead of resin, you minimize adhesion. The thing that Resin X sticks to best, is Resin X!

I'm sure there are other considerations that will help keep you from using mold release. However, there are occasions where you really need a top quality mold release.

How do you pick the right mold release?

There are many types of mold releases: silicones, paintable silicones, PTFEs, stearates, etc. Selection is dependent on many factors.

- Are you looking for a "universal" release so that you avoid the confusion of having several releases in your plant? This simplification will probably give you less than the best release for some jobs.
- Will parts require sonic welding or be finished by: painting, hot stamping, screen-printing, pad printing, vacuum metalizing, electroplating, etc.? Some releases cause adhesion problems. Often the lack of good adhesion is not apparent until after the part is in service with the consumer. Regular silicone releases are not acceptable but paintable silicones usually are. [**Any release applied in excess may cause an adhesion problem.**]
- Are FDA approvals required? Medical molding and parts for food applications may require a release that has FDA approval.
- Is UL recognition required?
- Is the application for the electronics industry? Silicones and paintable silicones when degraded by an electrical arc are oxidized to silica, which is an excellent electrical insulator. Since release "oils" creep, they may wind up on electrical contacts. This is not serious on power applications with 110 volt or more systems, but is deadly on millivolt systems such as computer connectors, etc.
- Does the release contain Ozone Depleting Chemicals [ODC's] or hazardous materials? Government regulation continues to play a larger role in the type of solvent systems used in releases. In meeting corporate goals concerning ODCs and hazardous materials, trade offs are involved. Replacement releases usually have some disadvantages. Because of government mandated restrictions, price tends to be greater for these newer releases.
- Are you molding a solvent sensitive resin? Styrenics such as ABS, Styrene, Polycarbonate, SAN,

etc. are sensitive to chlorinated solvents which can cause surface blemishes or stress cracking. Polycarbonate is well known for stress cracking after the part is put in service. This is a real booby trap and horror stories abound!

- Are you going to automate the release application? Some releases require agitation. It is anywhere from awkward to impossible to use these releases.

How do you evaluate a release?

Once you have narrowed the choices for releases by considering the appropriate factors noted above, it is necessary to make a factory trial. How do you do that, so that the results are meaningful?

- Plan an evaluation, don't just hand it to an operator to try, and then get his opinion. You may get the right answer, but consider yourself lucky if you do. To get meaningful results you need to treat the evaluation as a scientific experiment with appropriate standards and procedures.
- Evaluate using your toughest part, if possible, for a preliminary test. If that looks good, try on other parts molded with a variety of resins.
- Note whether the spray pattern gets the release on the mold. Some releases require that the spray can be held closer to the mold than other releases. For example the HCFC solvent/propellant systems evaporate much more quickly than the CFC systems. Thus the release is dry almost instantly. The micro droplets of release have a very small mass and air resistance may prevent them from reaching the mold unless the spray is emitted closer to the mold. This point is typically not recognized by the operator.
- Make sure that you have a benchmark for comparison. If you are spraying every sixth shot on part X, be sure that you couldn't do with every seventh or eighth.
- Make sure that old release is not affecting the results of the release under evaluation. You could stop and clean the mold, but the better way is to mold with the new release until you have four or five applications of release required. After that take your measurements of performance. For all practical purposes the old release is gone. Run at least five sets of applications with release and part removal, more if necessary. Mark the parts in the order they were molded. When you look for adhesion problems you may find that the first part molded always has a problem but the others don't. Or you may see stress marks on the last piece.
- When evaluating for adhesion problems, **do not spray parts directly with release** and then go to the hot stamp machine or paint line to see if there is a problem. Of course there is a problem! You have too much release on the part. Only use molded parts for that evaluation.
- Be sure that molding conditions do not change during the trial. For this reason it is best to set up and make evaluations of all releases at one press operation session.
- Work with the press operators so that they are a part of trying to find a better release. They usually spot problems or advantages quickest, since they spray release all the time.
- After picking the most effective release(s), run the test job with a single full can and record the number of parts that are molded. From that, cost effectiveness can be determined. Here's where you find out whether this is "the right stuff".

- All too frequently, release purchases are made on the basis of the cost per can. There are two problems with that. Who cares what the cost is, if the release doesn't work. Some cans have different volumes and what you are really interested in, is **how many parts can be molded for the dollar spent on release.** Now that you have the facts established by your release evaluation, you can calculate the best release for the buck for that particular resin and part. Here's how:

- From the price of the release per case [based on the volume at which you will buy], calculate the cost per can. Take that cost and divide by the number of parts that you were able to mold with a full can. This gives you the answer you need [$ per part] to compare with other releases that have been subjected to the same evaluation.
- For example you released 1305 parts from a can of "Snakebit 801". You would buy 801 at $32.60 per case of 12. $32.60/12 = $2.55 per can. $2.55/1305 = $0.00195 per part or **0.195 cents per part using Snakebit 801**
- Your standard, "Old Faithful 333" sold for $24.72 per case of 12 and you molded 875 parts per can. $24.72/12 = $2.06 per can. $2.06/875 = $0.00235 per part or **0.235 cents per part molded using Old Faithful 333.** To check the comparative costs 0.235 cents per part[for OF333]/ 0.195 per part [for S801] = 1.205. That means **Old Faithful cost 20.5% more per part molded than the Snakebit product**. If your buyer can't see the advantage of buying the higher priced material, you need a new buyer. Sometimes, higher priced materials do not perform as well as lower priced ones. "You get what you pay for, is not always true!" ***The only way to find out is to make an evaluation that is designed and controlled to compare "apples with apples".***

In addition to the comparison, which determines how many parts are molded per dollar of release, improved productivity should be considered. Consider the case of a part requiring a 30 second cycle plus four seconds whenever it requires spraying of mold release. If the more effective release allows you to spray every eighth shot instead of every sixth shot you will get five more shots in an eight-hour shift. This is a little over 0.5% increase in productivity. On a $40.00 per hour press that saving is worth approximately $0.20 per hour. On an annual basis of 85% utilization of the press, that amounts to savings of $1489.