Semi-Permanent Release Agents for Silicone Rubber

Use of Release Agents to Maximize Profitability

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External Mold Release

- Prevents adhesive bonding of rubber to the mold.
- Ensures high quality part surface.
- Two different types of mold release agents currently used: Conventional and Semi-permanent Release Agent.
Conventional Mold Release Agents for Non-Silicone Rubber

- Silicone is the most common release agent, and it is available in solvent-based and water-based forms.
- Works by transferring significant portion of release film to the molded part.
- There is little or no bonding to mold; no cross-linking.
- Molded parts bonded later will require extensive cleaning.
Conventional Mold Release Agents for Silicone Rubber

- Soap is the most commonly used release agent for this material.
- Works by transferring significant portion of release film to the molded part
- Little or no bonding to mold; no cross-linking
- High surface tension of soap solution yields a difficult ease of release.
Semi-Permanent Mold Release Agents for Non-Silicone Rubber

- Cross-linkable polymers that are available in solvent-based and water-based forms.
- Require a short cure time allowing carrier to evaporate & release polymers to bond a mold.
- Bonding is responsible for durability and abrasion resistance (hence multiple releases).
- Use of SPRA results in continuously cross-linked release film with low transfer to part, low build-up on mold, and low defect rate.
Semi-Permanent Mold Release Agents for Silicone Rubber

- PTFE is the most common SPRA. It is available in solvent and water-based forms.
- 100% Fluoropolymer cross-linkable polymers is the latest SPRA technology.
- Bonding is responsible for durability and abrasion resistance (hence multiple releases).
- Low surface tension is responsible for ease of release.
How Does the New 100% Fluoropolymer SPRA Work?

- The 100% fluoropolymer SPRA actually forms a clear, colorless, chemical bond to the metal surface of the mold. When the mold has been thoroughly cleaned, this SPRA will instantly cure to the hot metal mold.

- This extremely strong bond will give you multiple releases before any touch-up is needed.

- Complete inertness to the silicone rubber regardless of Shore A hardness is realized via the 100% fluoropolymer chemistry.

- Extremely low surface tension allows film to form even over a Teflon or Chrome mold surface.
Five Determining Factors for Choosing a Mold Release:
Factor #1: Environmentally Safe

The FIRST FACTOR to consider in choosing a mold release is how to meet the requirements of the Clean Air Act Amendments of 1990. A total ban of Class 1 ozone depleting substances has gone into effect since December of 1995.

EZ-Kote water-based mold release agents meet all environmental standards now and into the future.
Environmental and Safety Issues

- Recent proposals in environmental and safety legislation will restrict or phase out use of solvents such as CFC’s, 111-trichloroethane, methylene chloride, and volatile organic solvents due to associated risks.

- Currently known potential risks of solvents include ozone depletion, global warming, and health hazards to workers.

- The majority of new product development in semi-permanent release agents aimed at meeting and exceeding current solvent-based product performance with water-based products.
Factor #2: Ease of Release

- The **SECOND FACTOR** and most important aspect of any water-based mold release is the ability to provide easy release without contaminating the mold. This should be obtained with minimal transfer to the part.

- One method of assigning a relative value of ease of release is to measure the “break away” force needed to separate the part from the mold. This value is a measure of “slip” that would be applied to the mold surface.
EASE OF RELEASE
Lap Shear Testing
PSI

Dow Corning Silicone Rubber 60 Shore A
EASE OF RELEASE
Lap Shear Testing
PSI

EPDM with 2.6% Saret 633 Metal Adhesion Promoter
Factor #3: Durability

- The **THIRD FACTOR** in determining how well a water-based mold release will function is to measure its durability.
- Durability is determined by how long it will continue to give good releases before it is worn off and needs to be reapplied.
DURABILITY
Rheometer Evaluation
# of Releases

Dow Corning Silicone Rubber
DURABILITY
Rheometer Evaluation
# of Releases

- Neoprene
- Viton
- Vamac
- EPDM

- EZ-Kote HMT
- EZ-Kote R2
- Aqualine R110
Relationship Between Transfer and Durability

- Semi-permanent release agents exhibit very low transfer to finished parts compared to conventional release agents.
- Slow continuous abrasive wear of release film until it is eventually abraded from mold.
- Severity of wear/transfer is determined by release agent used, rubber stock being molded, and molding conditions.
- Careful matching of release agent to rubber stock can optimize entire process.
Factor #4: Inertness

- The **FOURTH FACTOR** will determine the effect the water-based mold release has on the surface of the part. If the release agent doesn’t release the part from the mold with a good surface finish, then it may be reacting with the elastomer.

- Water-based SPRA impart equal or better cosmetics than the best solvent-based release agents. When properly applied, they will also protect the mold from rusting. This eliminates the need to oil the mold for storage.
Factor #5: Cost

The FIFTH FACTOR is a function of the following process variables:

- number of releases per gallon of SPRA.
- scrap rates (cost of raw material per part)
- mold cost (number of molds in production)
- labor and overhead
- down time (mold fouling and cleaning)
- cycle time (0 cure-time for SPRA)
- ease of “demolding” (parts don’t stick to the mold)

Solvent prices increased over 100% in 2005.
Steady State Process

- Reaplication of SPRA to keep ease of release variable within process parameters.
- All elastomers can be easily released regardless of fillers, co-agents, or curatives.
- 99%-100% yields on all parts regardless of design.
- Cost of SPRA is less than $0.05 per square foot of mold area.
- Molds stay cleaner up to 40 times longer. Mold cleaning costs, storage costs, and number of molds needed to be purchased are greatly reduced.
Take a Look at What Water-Based SPRA Have to Offer

- Solvent free
- Superior ease of release
- Multiple releases
- Better cosmetics
- Easier to use
- One product versatility
- Meets all EPA requirements
- Can be FDA approved
- Instant cure
- No transfer
- Lower cost
- Higher productivity