

Semi-Permanent Release Agents for Silicone Rubber

Use of Release Agents to
Maximize Profitability

By: Bill D. Stephens, EZ-Kote Inc.

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.

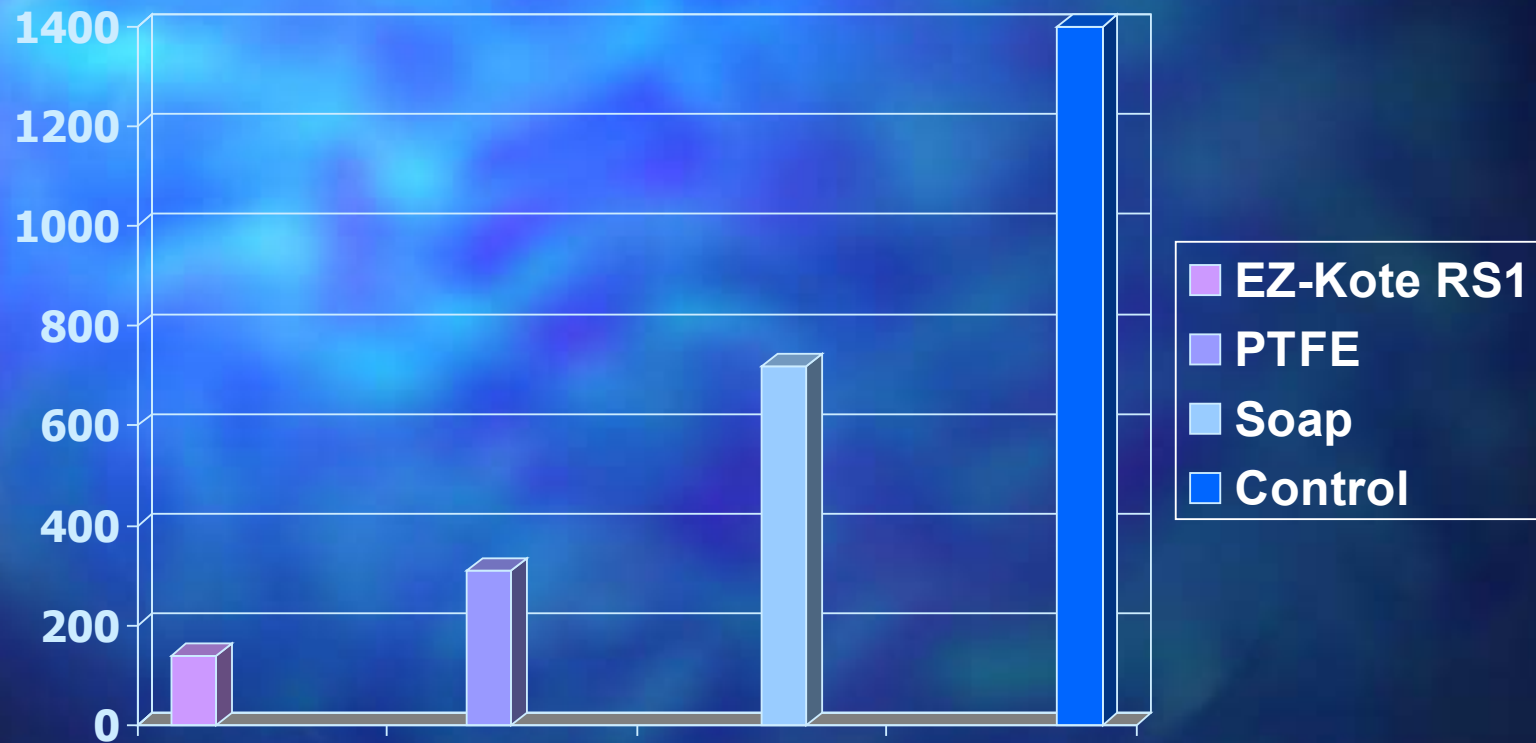
Factor #2: Ease of Release

- 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

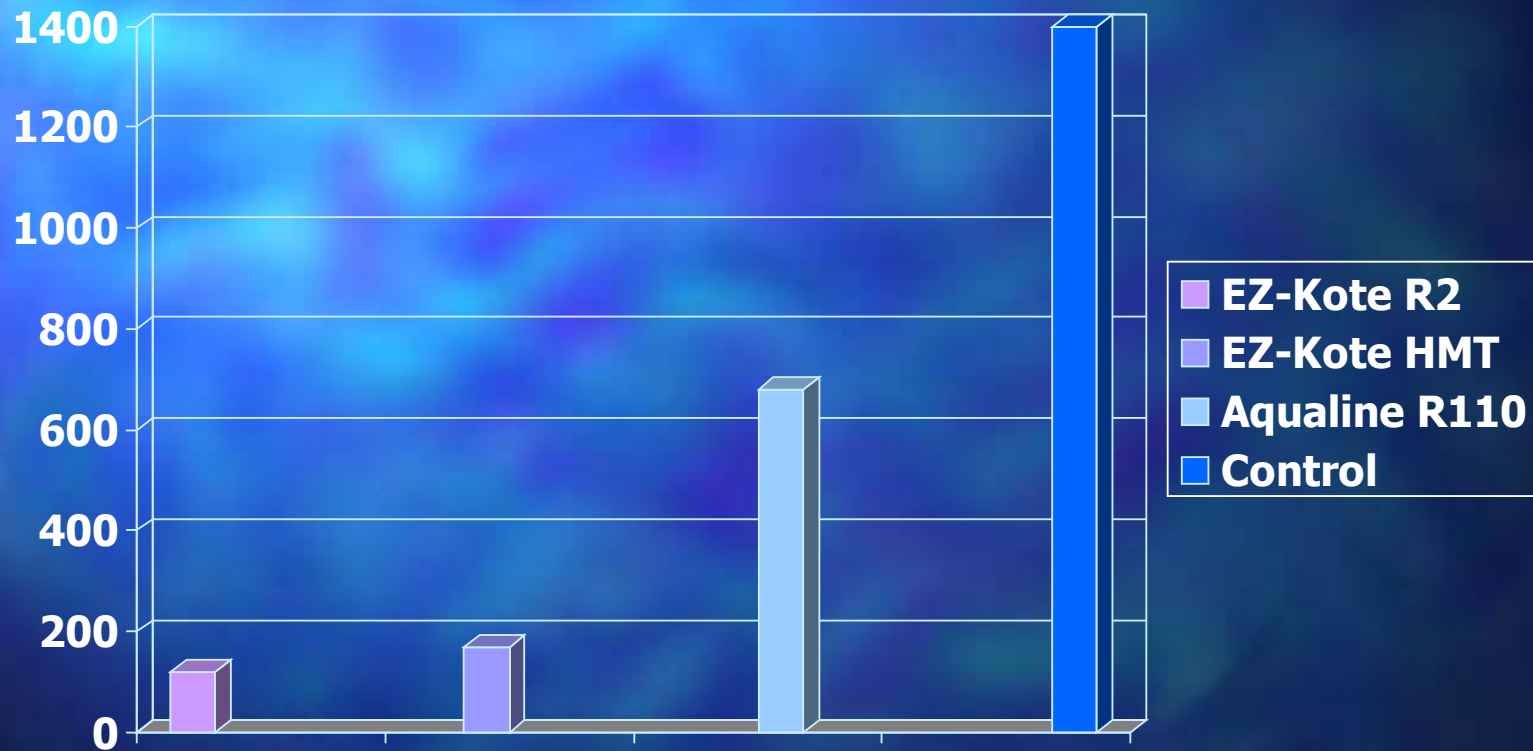
Lap Shear Testing

PSI



Dow Corning Silicone Rubber 60 Shore A

EASE OF RELEASE Lap Shear Testing PSI



EPDM with 2.6% Saret 633 Metal Adhesion Promoter

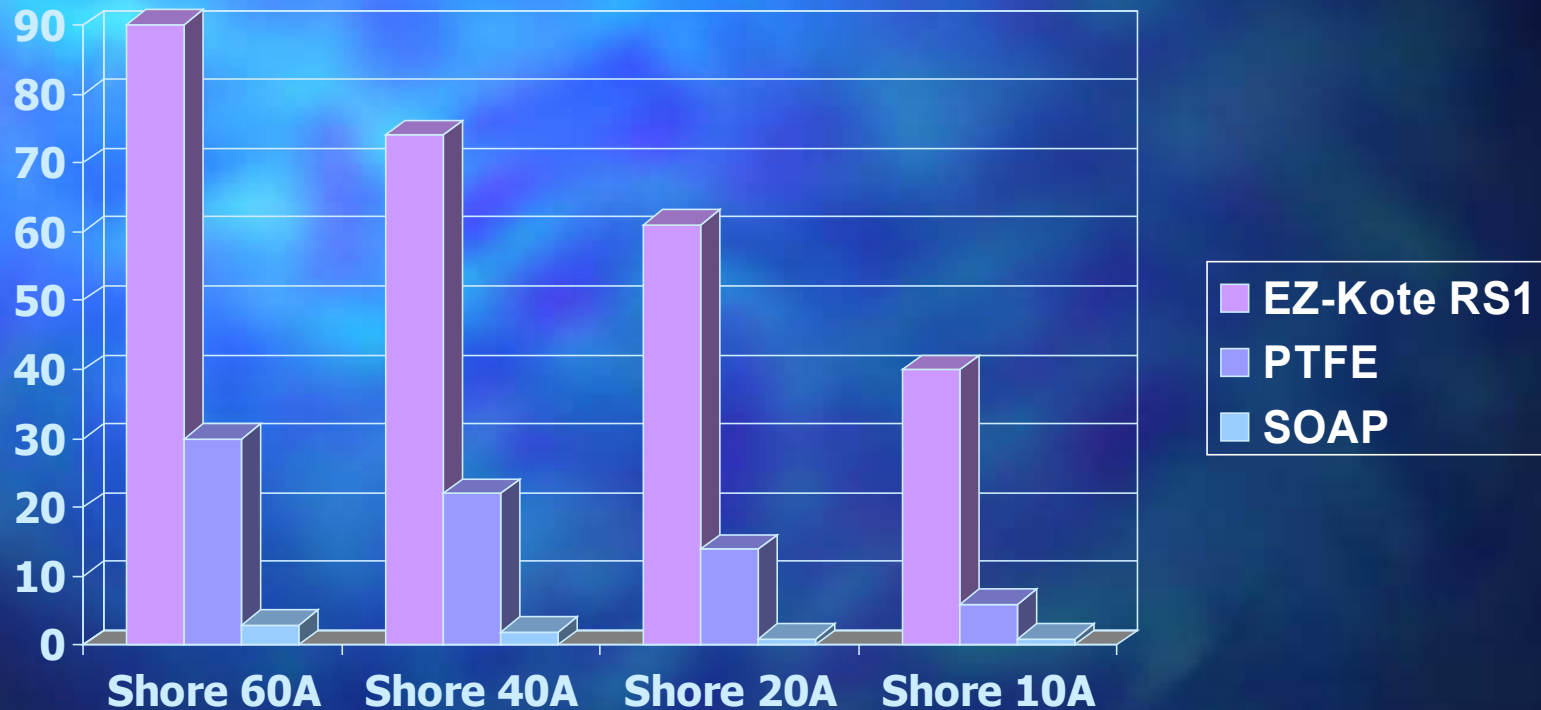
Factor #3: Durability

- 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

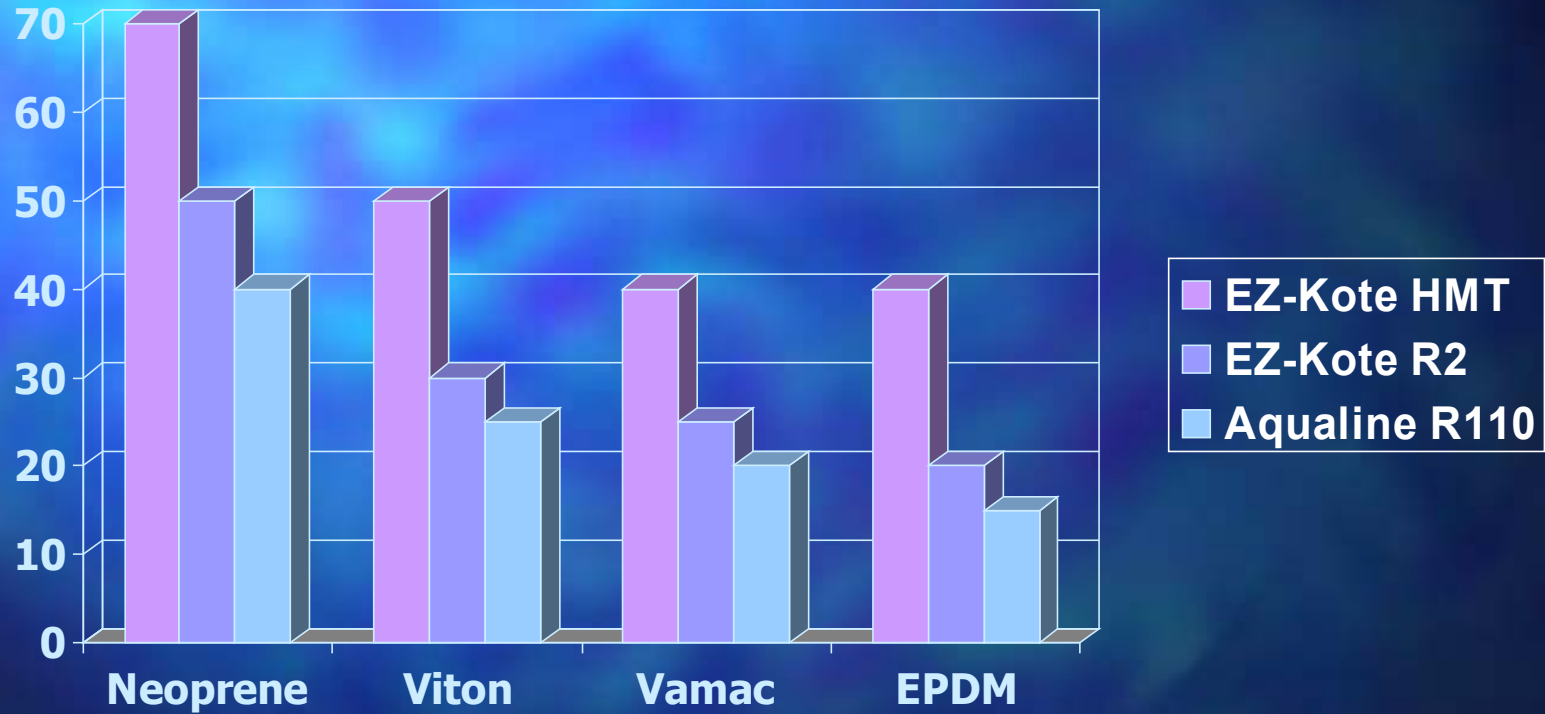


Dow Corning Silicone Rubber

DURABILITY

Rheometer Evaluation

of Releases



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

- Reapplication 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