PERFORMANCE SHEET

DIE SLICK® 4520 SERIES

Background

The DIE SLICK® 4520 Series are synthetic lubricants which contain a blend of reactive polymeric lubricants.

DIE SLICK® 4520 Series Industry Applications:

- Automotive
- Heavy equipment
- Lawn & garden
- Electronic
- Consumer goods

Smart Polymer Technology

The formulations in this series incorporates Smart Polymer technology and high molecular weight alkane cross-linking agents. Uneven protection caused by temperature variation on a die surface is a long-standing challenge in the die casting industry. Temperature variation is caused by the wide-range of die size, design, complexity, parts produced, and heat profile of each system. Traditional die lubricants, unable to adapt to the disparity in die temperatures, can be suitable at protecting hot areas of the die but can cause residue build up in cooler, less demanding areas. This costly dilemma causes solder, lost production time and extra die maintenance. DIE SLICK® 4520 Series lubricants with heat activated Smart Polymer technology evolved from these challenges. These polymers were developed to form a tough protective die coating when exposed to hot areas of the die while not leaving residue build up in cooler areas.

Series Benefits

- Forms a tough thermodynamically activated die film that resists soldering on hot die areas while not building on cooler die areas. This translates to decreased downtime due to reduced die maintenance, improved part quality, and prolonged die life
- Castings are extremely bright and clean
- No staining improves production by reducing scrap and rework, and reduces the cost per part produced
- Does not cause downstream paint or coating problems
- Exhibits excellent emulsion stability when diluted, lowering consumption
- Minimal smoke provides a cleaner working environment and improves air quality for operators

Effective Product Recommendation

Since die casting production trials typically require significant equipment and resources, and involve time investments and casting loss, Quaker Houghton has established a 4-part laboratory test method for chemical testing to evaluate die lubricants and generate product recommendations. This chemical testing method is an effective approach to obtain baseline data, which is used in context of the customers objectives to determine an appropriate replacement product.

Quaker Houghton's testing methodology greatly streamlines the lubricant selection process, assists in optimization, and can be completed within hours. This eliminates the need for extensive, time-consuming process surveying. This lab evaluation method consists of four tests including solids content, visual analysis, thermogravimetric analysis, and infrared spectroscopy.

- **Solids content** – Determines amount of active content in die lubricant
- **Infrared Spectroscopy (FTIR)** – Indicates what the functional components are in the lubricant
- **Visual analysis** – Reveals what a lubricant will look like on the die face, demonstrating if it will stain or build up

Visual Comparison of DIE SLICK® 4520 Series vs. Competitive Product

DIE SLICK® 4520

Competitive Product

The visual comparison shows the cleanliness of the lubricant after it has been exposed to high temperatures on the die surface. Products that turn brown when exposed to high heat may result in stained castings.

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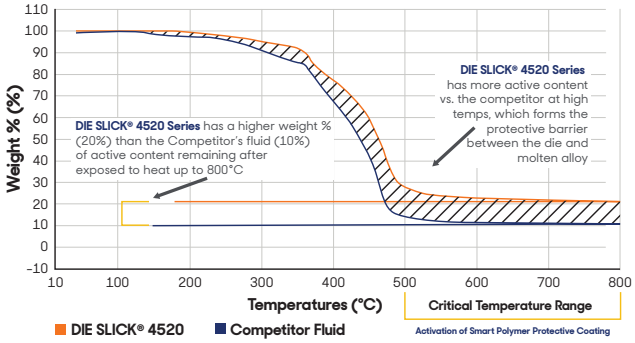
DIE SLICK® 4520 SERIES

- **Thermogravimetric analysis (TGA)** – Presents how much protection a die lubricant will offer at critical temperatures

TGA Curve Comparison of DIE SLICK® 4520 Series vs. Competitive Product



TGA is used to evaluate the thermodynamic stability of the active content (non-water material) of a die lubricant. This is a measurement of how much heat a lubricant can tolerate before decomposition, which is graphed as weight percent versus temperature.

Case Study: Reducing Solder Casting Engine Blocks

Challenge: A global supplier of aluminum automotive components who manufactures high pressure aluminum die castings for major automotive companies was facing issues with their die casting operations and was specifically looking to:

- Reduce cost
- Improve performance by reducing solder

Solution: Based on a thermal image study of their more complicated die castings, Quaker Houghton recommended the customer switch to the DIE SLICK® 4520 Series. After a trial period replacing the competitor with the DIE SLICK® 4520 Series, Quaker Houghton was able to:

- Increase the dilution factor by 15%
- Obtain unanimous approval by all departments including operations, engineering, purchasing, and safety, health and environmental

This resulted in a substantial savings of 40% through lower cost of product and reduced product usage, reduced solder and improved overall uptime.

Case Study: Reduced Blistering and Spray Time Casting Automotive Structural Castings

Challenge: A major global supplier of lightweight conventional and structural die cast parts to the automotive and industrial industries was experiencing production issues. The customer was facing an average scrap rate of 36% due to blistering on structural castings with the competitive product and was looking for the following improvements:

- Reduction in scrap rate due to blistering
- Maintain a good cosmetic appearance
- Eliminate issues with castings sticking to the dies

Solution: Quaker Houghton performed the 4-part laboratory test method including FTIR spectroscopy, a visual residue comparison, Thermogravimetric analysis (TGA) and solids content testing for the competitive product vs. the DIE SLICK® 4520 Series product. This revealed that DIE SLICK® 4520 Series had significant-ly higher thermal stability between 400°C and 800°C which would improve production issues. The visual comparison showed that the DIE SLICK® 4520 Series burned cleaner than the competitor, translating to lower residue,
cleaner machines, and decreased tendency for staining. By switching to the DIE SLICK® 4520 Series the customer benefited from:

- 44% Decrease in blistering from 36% to less than 20%
- 26% Spray time reduction from 9.5 seconds to 7 seconds
- Improved production time due to the reduction in re-manufacturing scrapped parts
- Reduced water use and waste treatment costs
- Ability to produce more good parts/hour with better machine capacity, extending the die life

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