



Molykote®

60 Years of Smart Lubrication™

Since 1948, many of the world's most demanding lubrication challenges have been successfully met with Smart Lubrication™ provided by Molykote® brand lubricants. Sometimes called “miracle lubes,” Molykote lubricants were initially based on molybdenum disulfide (MoS_2) and have expanded to include a wide range of solutions from mineral oils to synthetics. The common elements in all products are lubrication expertise and trusted performance. This is the story of a thriving 60-years-young business, born from centuries-old discoveries.

Molybdenum Discoveries

The story begins more than 250 years ago, when the lubricating properties of an unknown ore were noted in 1744 by Johann Alexander Cramer in *Elementa artis docimasticae* (Elements of ore analysis). The ore was similar to lead, galena and graphite, and these substances were labeled with the Greek word “molybdos,” meaning lead-like. He wrote: “Therefore, workers burnish their presses and other instruments with molybdena instead of soap, partly to make them easier to slip.”

In 1778, a Swedish scientist, Carl Wilhelm Scheele, identified molybdenite as the sulfide of a distinct metallic element by heating it to yield a white oxide powder. At his suggestion, Peter Jacob Hjelm, another Swedish chemist, successfully isolated the metal in 1782 and named it molybdenum.



These discoveries remained curiosities, since molybdenum occurred in a natural state only chemically combined with other elements. When extraction of commercial quantities became practical more than 100 years later around 1890, the first uses of the ore were as a substitute for tungsten in strengthening steels. World War I severely strained the supply of the metal, and a molybdenum company was formed to begin mining and processing a huge deposit found years earlier in the U.S. Colorado mountains.

Today, significant molybdenum resources are available throughout the world, and the U.S., China, Chile and areas of Russia are leading producers. The greatest share of the “slippery metal” ore is used in steel processing, with less than 20 percent used in chemical catalysts and solid-film lubricants.



ALFRED SONNTAG

New Dimension in Lubrication

In 1935, the remarkable lubricating properties of molybdenum were put to use. Alfred Sonntag, an engineer of German descent, designed a huge, nearly 60-foot-tall test machine for a Philadelphia-based company to simulate aircraft vibrations. In its first test, the machine failed because of severe stick-slip.

No available lubricant worked, but Sonntag found mention of molybdenum in the 18th century writings. Trying out this slippery mineral, he discovered a new dimension in severe-duty lubrication. In 1940, he formed Sonntag Scientific Corporation to develop and evaluate molybdenum-based lubricants. With continued mining of the ore for growing metallurgical uses, Sonntag had a ready supply for his studies.

Since the ore was normally contaminated with quartzite, Sonntag Scientific developed techniques for purifying molybdenite into the MoS₂ lubricating powder in use today. It also developed the first lubrication test machines. More than 4,000 samples of the “miracle” lubricating powder were sent to research institutes and industrial laboratories for evaluation and potential commercialization.



Molykote® Debuts Worldwide

In 1948, with response to his sampling activity overwhelmingly positive, Sonntag established Alpha Molykote in Stamford, Connecticut. The name was derived from “moly-coating” and the specialty lubricants debuted with the slogan, “Molykote is purest molybdenum disulfide.” Alpha Molykote produced the world’s first MoS₂ lubricants.



Sonntag proceeded to publish various papers on the effectiveness of Molykote products for uses where conventional lubricants failed. The lubricants supported extremely high loads, withstood high and low temperatures, prevented fretting under static loads, stopped high wear rates, prevented seizure between similar metals and provided long-lasting lubrication in dusty, abrasive environments where the day's more typical lubricating oils and greases collected grit and acted as grinding compounds.

Some first products included Molykote powders for use in plastics, sinter bearings and camera-shutter tumblers; pastes for hot screw threads, splined shafts, press fittings and oven bearings; a grease for highly loaded bearings; a dispersion for gear oil additives; and, a bonded lubricant for aircraft parts.

Powders delivered solid lubricant particles with excellent load-carrying ability, low friction, thermal stability and chemical inertness where clearances were critical. **Pastes** blended powders with various fluids for uses needing surplus solid lubricant and corrosion protection. **Greases** were similar to pastes, but especially formulated for extreme-pressure lubrication and extended service intervals. **Dispersions** suspended solids in lubricating fluids for anti-wear, extreme-pressure additives to ordinary lubricants. **Bonded lubricants** blended the solids with resinous or inorganic binder-solvents for maximum wear endurance in uses where other lubricants could not be contained.

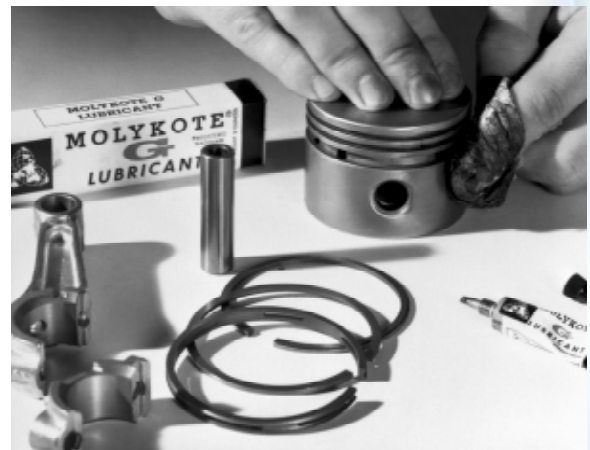
Molykote® Soars to Success

Within a few short years of their debut, Molykote brand lubricants soared in worldwide availability and rapidly expanding application. As the Alpha Molykote sales organization grew, the capabilities of these unique solid-film specialty lubricants became more universally known. The various forms of the lubricant became favored in severe-duty production and technology lubrication applications globally.

In the early 1950s, Alpha Molykote established key product distributorships in different world regions, including among others, Molykote KG in Germany and the Mitsubishi trading company in Japan.

Interestingly, during a 1952 study of the lubricating properties of molybdenum disulfide powder at the Munich Spengler Institute for Mineral Oils, a survey of university professors revealed the opinion that the annual demand for MoS_2 might reach 50 kg per year. By 1955, this was exceeded in Europe alone.

By the mid '50s, the Molykote KG sales operations expanded throughout Germany and added a small filling line and research



laboratory. Molykote KG also partnered with Alfred Sonntag and established production facilities in the basement of a former restaurant. By the end of the decade, Molykote GmbH served more than 12,000 customers and had close partnering relations with 19 foreign distributors.

1960s Bring Growth & Change

Entering the 1960s, Alpha Molykote was strong and enjoying considerable sales growth in Europe, driven primarily by Molykote GmbH. This aggressive marketing partner held numerous engineering seminars, came up with the idea for Molykote G-Rapid Spray – the first MoS₂ lubricant paste in an aerosol form – and even built a new plant in Munich for producing licensed Molykote products.

Other new products introduced in the early '60s included Molykote white pastes for "clean lubrication," metal-forming lubricants and Molygium, a self-lubricating composite.

In 1964, with Alfred Sonntag ill, Alpha Molykote was sold to Dow Corning Corporation in Midland, Michigan. A pioneer in silicone chemistry since 1943 and a major supplier of lubricating materials for special applications, Dow Corning welcomed the addition of Molykote solid-film lubricants. The line complemented the company's silicone and fluorosilicone lubricants, which performed exceptionally in adverse environments, yet did not have the load-carrying capabilities of the Molykote products.

Dow Corning also gained one-third ownership of Molykote GmbH as part of its purchase. Later, it acquired full ownership and renamed the company Dow Corning GmbH. In the U.S., Dow Corning then moved the Alpha Molykote production operations from Stamford to Trumbull, Connecticut, and began producing its silicone and fluorosilicone lubricants there as well.

The Molykote brand continued to expand in the '60s, with sales growing significantly each year. Rising volumes and new applications were especially evident in the maintenance market of power, chemical and steel plants and then the OEM automotive market. During this time, other solid lubricants such as metal sulfides, metal fluorides, metal phosphates, graphite and other powdered metals were found to have synergistic effects and became the basis for a number of new Molykote products.



Silicones Fuel Brand Expansion

Significant changes and continued sales growth took place throughout the 1970s, as Dow Corning's globalization deepened and marketing strengthened. One major change occurred when the company's silicone-based lubricants were consolidated into and promoted with the Molykote brand name.

Other changes for growth involved marketing Molykote products to the South American automotive industry. In Europe, silicone greases gained strength and the Munich operations began making their first silicone lubricants. In Japan, Fuji Kobunshi replaced Mitsubishi as the Molykote importer and, in 1975, the firm started a Molykote plant. Later, as a wholly owned subsidiary, it was renamed Dow Corning Kabushiki Kaisha.

In the early '70s, for the first time, the lubricating mechanism of molybdenum disulfide was studied using scanning electron microscopy (SEM). The excellent lubricating properties of MoS_2 were due to its ability to fill rough metal surfaces with a thin film of "slippery" lamellae (sliding planes), which adhered strongly, provided an ultra-low coefficient of friction and withstood extremely high pressures.

Some of the new products in the '70s included pastes and anti-friction coatings allowing alternative application methods, friction-control additives for brake pads and linings, and Molykote "plus" greases.

Added Capacity & Strategic Partnerships

Much of the progress for the Molykote brand in the '80s involved a new production plant in Yamakita, Japan, continuing product expansion and increased growth in the automotive industry.

New products included water-based and oil-resistant coatings, advanced silicone greases, improved Molykote "plus" greases, *Lubolid*® additives for asbestos-free brake pads and even some wear-reducing products with no lubricating properties at all. In addition, as many more plastics were being used as design materials, Molykote also added various "plastic greases" to its expansive lines of specialty lubricants.

The decade witnessed many strategic alliances established between Molykote and automotive vehicle manufacturers as well as the aftermarket service providers. The Molykote channel partners also began taking on and marketing other lines of Dow Corning silicones.



More Opportunities Open in the '90s

Even more success came to the Molykote brand in the 1990s. The huge, untapped markets of Eastern Europe opened. And, a Molykote book was published with over 40 years of Molykote knowledge for the world's engineers and technicians. Both events greatly expanded opportunities for the brand.

In the early-90s, the Dow Corning Kabushiki Kaisha and Dow Corning Japan operations consolidated and were renamed Dow Corning Asia, as a wholly owned subsidiary. In the mid '90s, Dow Corning's Wiesbaden site was expanded with new Molykote labs and production facilities and Molykote R&D and production relocated from Munich to Wiesbaden.

Numerous new product offerings also came on stream. These included Lubolid-mixing equipment, an oil-resisting piston coating that delivered lifetime lubrication, unique "polarized graphite" additives for replacing lead compounds in clutch linings and reducing noise in brake pads, and patented anti-friction coating technology for many "anti-squeak" automotive applications.

Also, a Molykote paste was specified and globally implemented for lubricating threaded connections in aviation and power plant turbines. This advanced technology led to other lubricant pastes for threaded connections in plastic molding machines and eco-friendly, corrosion-resistant railway connectors.

Celebrating Success in a New Millennium

With the dawn of a new millennium, Molykote marked more than a half-century of business success. It was time for a redesigned brand identity and a new, globally bold and confident look and feel emerged. The brand's primary market message became: "**Molykote is Smart Lubrication™.**" And, the four key attributes that represented the brand's essence were: **Expertise ... Trust ... Complete ... Smart.**

Another key development occurred when an "Online Bulletin Board" was established to enable an on-going global exchange of key lubrication knowledge. A select group of lubricant specialists answered specific questions about Molykote products and applications, and the forum was instantly popular with authorized Dow Corning employees, Molykote application engineers, channel partners and customers.

Some of the other striking developments in the current decade involved innovations in lubrication test equipment and coating services. And, Molykote achieved a real milestone with its "Total



Lubrication Program," as it launched 42 new offerings in a well-rounded product line of synthetic oils as well as ultra-pure mineral oils in a broad range of viscosities. This line of non-MoS₂ lubricants was primarily for use in industrial machinery, with some oils suited for applications involving food contact.

In 2000, Dow Corning acquired its joint venture company in India and established a 100%-owned subsidiary to manufacture and trade Molykote and silicone-based specialty chemicals. The company established its enhanced manufacturing facilities in Pune in February 2006. Since 2005, after consolidation of all Dow Corning operations in Japan, Dow Corning Toray Co., Ltd. supplies both silicones and Molykote products and services. Yamakita remains a key center for these leading-edge technologies. Also, in 2007, the China Application Laboratory was established in Songjiang, China.

In 2008, the Molykote business celebrates the 60th anniversary of its founding. Alfred Sonntag, when he first commercialized a centuries-old research curiosity, surely could not have envisioned that the Molykote brand would grow to such sizable proportions. Today, the business has a global network of more than 3,000 channel partners, serves many thousands of customers worldwide and can solve or prevent virtually any lubricating problem, while increasing energy efficiency, with time-tested Smart Lubrication™ solutions.

While growth of the brand has been worldwide, the top markets include North America, Europe and Asia. The greatest growth areas going forward appear to be the emerging markets of Eastern Europe especially Russia, Brazil in South America and both India and China in Asia. Five market segments generally benefit most from Molykote brand lubricants: Automotive, Aviation & Aerospace, Industrial Assembly & Maintenance, the Food & Beverage Industries and Appliances & Office Equipment.

Leveraging the innovative heritage of Dow Corning and delivering global expertise and trusted lubrication solutions, the Molykote brand stands poised for many more decades of success in helping customers around the world to solve or prevent their toughest lubrication problems.

Molykote is Smart Lubrication ... and Dow Corning now celebrates its 60 Years of Smart Success.



How to contact us

Dow Corning has sales office, manufacturing sites, as well as science and technology laboratories around the globe. For more information, visit www.dowcorning.com or www.molykote.com.

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