The two major dry film lubricants are Tungsten Disulfide (WS$_2$) and Molybdenum Disulfide (MoS$_2$). These thin films, when applied, create a protective barrier between moving parts, reducing friction and wear.

MoS$_2$ is noted for its high lubricity, which is due to its layered structure and weak Van Der Waals forces. Under an applied lateral force, the layers collapse and the plates slip out of place. A strong ionic bond between the plates (basal plane) forces the slippage to continue, and the plates slide over one another and produce a “slipping” effect. MoS$_2$ is also noted for its high resistance to sliding and its low coefficient of friction.

WS$_2$, on the other hand, is noted for its high resistance to wear and its high thermal stability. It has a similar layered structure to MoS$_2$, but the layers are held together by strong ionic bonds, which make it more resistant to wear and more effective at high temperatures and pressures.

Dry lubricants in the dichalcogenide family have weak Van Der Waals forces and strong ionic bonds in the basal planes. At a micro level, the dry lubricant functions like a series of vertically stacked plates (basal planes). As a stress is applied, the layers support the applied force and the plates slip out of place. Under an applied lateral force, the legs collapse and the plates slip out of place. A strong ionic bond between the plates (basal plane) forces the slippage to continue, and the plates slide over one another and produce a “slipping” effect.

The lubricant has been used extensively in military and aerospace applications and in many industrial and automotive applications, including pre-maintenance long term storage. This coating is thicker than the impinged coating and provides excellent corrosion resistance.

Choosing the right dry film lubricant for your specific needs is often best left to your lubrication engineer. Micro Surface can assist in this determination based on our experience, and we can also provide prototype coatings for you to evaluate directly in your applications.

Micro Surface Corporation

Molybdenum Disulfide and Tungsten Disulfide Coatings

Advanced Dry Film Lubricant Coating Services From The Industry’s Dry Lube Specialists
Micro Surface – the specialists in dry lubrication coating

Forays into Micro Surface Corporation have been the go-to resource for the powder dry lubrication coating. And because the company has focused specifically on WS2 and MoS2 coatings, they’ve turned their expertise into a service – to the point of developing their own proprietary, provenance-optimized coatings performance.

Focused and affordable

Since Micro Surface concentrates exclusively an advanced high-facility that is both reliable and secure. Always looking out for the customer is key!

Optimizing WS2 coating with proprietary Process DL-99

In the process of experience, Micro Surface Corporation has developed its own proprietary technique for optimizing the application of the high-performance WS2 (DMS). This process is now shown (DIB-10444 Type I) and AMS 2526.

WS2 coating process developed for the efficient bonding of high pressure synthetic graphite dust into all surfaces. This process coats bearing surfaces without binder media and with no detrimental effects to the involved surfaces. This WS2 coating is suitable for use in high precision assembly without causing mechanical interference or requiring additional lube. Once applied, the WS2 coating becomes an integral part of the substrate and is not stacked, peeled or wiped off. Process DL-99 (WS2) always coat and wear resistant, stable and reliable in almost all atmospheres. The coating is impervious to most narcotics and is not one that requires periodic maintenance. In a situation where liquid media and tungsten are unprotected by a coating, WS2 coating can be more effectively than tungsten for high and high-temperature applications. It is not designed to provide substantial corrosion protection to the substrate.

Optimizing MoS2 coating with proprietary Process DL-99

To optimize the applications of molybdenum disulfide (MoS2), Micro Surface Corporation has developed its own proprietary Process DL-99 which now shown (DIB-10444 Type II) and AMS2526. The unique Process DL-99 incorporates lubricating components, metal and non-metallics and gives the benefit of corrosion protection in addition to lubrication. This coating is slightly thicker than some of Micro Surface Corporation’s other film lubricating coatings such as tin-extruder plate (MoS2). Process DL-99 was processed in the same manner (DIB-10444 Type II.) This process of film lubricating coatings starts with a high-performance Teflon-like coating consisting of the lubricating ingredients, molybdenum disulfide, bonded with medium and high grade graphite. After application and proper curing, these coatings bond the substrate to create a solid film lubricating coatings, greatly improved wear life and gives corrosion resistance in harsh environments. As required, the DL-99 becomes an integral part of the substrate and is not stacked, peeled or wiped off. Process DL-99 (MoS2 per Process DL-99)

AR9130 and DIB-10444 Type I

Character: Static-dedicated, static-free, impregnation applied per specification. This product has been used on metal parts and some nonmetallic parts where a friction-reducing coating under 0.00001" thick is required and where severe wear, galling, scoring and friction are caused, but usage is not limited to such applications. This lab coating film has been shown to be readable with liquid film such as silicone fluids, polyester-bonded hydraulic fluids, jet engine lubricants and solid rocket propellants, sodium hydroxide and acetic acid, hydrofluoric acid and sodium fluoride.

Applications for WS2 per Process SL-39

AR9130 and DIB-10444 Type I

Scope: Static-dedicated, static-free, impregnation applied per specification. This product has been used on metal parts and some nonmetallic parts where a friction-reducing coating under 0.00001" thick is required and where severe wear, galling, scoring and friction are caused, but usage is not limited to such applications. This lab coating film has been shown to be readable with liquid film such as silicone fluids, polyester-bonded hydraulic fluids, jet engine lubricants and solid rocket propellants, sodium hydroxide and acetic acid, hydrofluoric acid and sodium fluoride.

Applications for MoS2 per Process DL-99

AMS2526

MoS2 coating, impregnation applied per specification. This product has been used on metal parts and some nonmetallic parts where a friction-reducing coating under 0.00001" thick is required and where severe wear, galling, scoring and friction are caused, but usage is not limited to such applications. This lab coating film has been shown to be readable with liquid film such as silicone fluids, polyester-bonded hydraulic fluids, jet engine lubricants and solid rocket propellants, sodium hydroxide and acetic acid, hydrofluoric acid and sodium fluoride.

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Dry film lubricants work

Dry film lubricants—which we can call solid lubricants—apply between two surfaces in relative motion, in lower friction or lubrication wear. These materials do not form a tribochemical reaction in-situ. These dry film lubricants are often used in extreme environments where typical hydrocarbon-based lubricants can not work. These include very high or low temperatures, high or low pressure, and it delays but does not prevent corrosion. Molybdenum Disulfide (MoS₂) is a very active lubricant and is used in many of the same applications. Its usually seen as a material coating coating is due to its in-situ reactions. Typically it causes a reduction in coefficient of friction, a reduction in wear, and lubrication of metal parts. MoS₂ works in many different environments and delays but does not prevent corrosion.

MoS₂ per Process SL-39
MoS₂ is a very active lubricant and is used in many of the same applications. It is usually seen as a material coating because of its in-situ reactions. Typically it causes a reduction in coefficient of friction, a reduction in wear, and lubrication of metal parts. MoS₂ works in many different environments.

How dry lubricants work

Dry film or “solid film” lubricants are solids applied between two surfaces in relative motion, to lower friction or reduce wear. These materials differ from traditional lubricants, such as oil and grease, in that they are not suspended in a liquid medium. Instead, they are applied as a solid film or coating. Dry film lubricants are often used in extreme environments where typical hydrocarbon-based lubricants can not work. These include very high or low temperatures, high or low pressure, and it delays but does not prevent corrosion. Molybdenum Disulfide (MoS₂) is a very active lubricant and is used in many of the same applications. It is usually seen as a material coating because of its in-situ reactions. Typically it causes a reduction in coefficient of friction, a reduction in wear, and lubrication of metal parts. MoS₂ works in many different environments.

Tungsten Disulfide (WS₂)
The two major dry film lubricants are Tungsten Disulfide (WS₂) and Molybdenum Disulfide (MoS₂). These dry films, along with graphite, are classified as solid lubricants and are sometimes referred to as ‘solid lubricants.’ To provide low friction, these dry film lubricants feature low shear strength and adherence to the surface. These materials have a special crystal formation that causes them to form a thin, flexible film that readily slides over one another and produces a ‘sliding’ effect.

Dry lubricants in the sfalolol family have various friction mechanisms that involve either metallic bonds or polymer-like bonds. In slalolol lubricants, the frictional force increases with increasing pressure, as the polymer-like bonds are more likely to break and release free ethylene oxide units. This reduces the frictional force, allowing the lubricant to function effectively. The lubricant also offers wear protection and corrosion resistance, making it ideal for use in extreme environments such as high temperatures and high pressures.

Dry film lubricants are commonly used in applications such as metal finishing and forming, precision machinery, aerospace, and automotive engineering. They are especially useful in applications where conventional lubricants are not effective, such as in high-temperature environments or in the presence of aggressive chemicals. Dry film lubricants provide a solution to these challenges by offering long-term lubrication and protection against wear and corrosion.

Tungsten disulfide is a material that can be substituted for traditional lubricants in extreme environments. It is used in a wide range of applications, from aerospace and defense to industrial and automotive sectors. WSe₂ has unique properties that make it an excellent choice for dry film lubricants, including its high melting point, excellent wear resistance, and low friction properties. These characteristics make WSe₂ an ideal choice for a variety of applications, including high-temperature bearings, aerospace components, and industrial machinery.

Molybdenum disulfide is another material that can replace traditional lubricants in extreme conditions. It is commonly used as a high-temperature lubricant for applications such as high-temperature bearings, aerospace components, and industrial machinery. MoS₂ is known for its excellent wear resistance and low friction properties, making it a popular choice for high-temperature applications. However, it is important to note that MoS₂ has a lower melting point compared to WSe₂, which limits its use in applications requiring higher temperatures.

In conclusion, dry film lubricants are a versatile and valuable technology that can be used in a wide range of applications where conventional lubricants are not effective. They offer long-term lubrication and protection against wear and corrosion, making them an ideal choice for high-temperature environments and other challenging conditions.
Micro Surface – the specialists in dry lubrication coating

Micro Surface Corporation has been the leader in high-performance dry lubrication coatings. And because the company has focused specifically on WS₂ and MoS₂ coatings, they have their expertise in a single category – to the point of shifting their proprietary processes towards optimization and success.

Focused and affordable

Since Micro Surface focuses exclusively on advanced WS₂ and MoS₂ coatings, they understand many of the special requirements involved in dry film applications across numerous industries, including the unique challenges and performance parameters unique to each. Their unique specialization and years of experience make them a uniquely outstanding partner. And their focus has allowed them to deliver products of outstanding performance, anywhere.

Optimizing WS₂ coating with proprietary Process DL-99

To optimize the application of molybdenum disulfide (MoS₂) Micro Surface has developed its own proprietary Process DL-99 for use of these processes. AASHTO M4461-87, MIL-R-51484A, DOD-L-85645A.

The unique Process DL-99 incorporates various metals, binders and a coating process, and can be used in a manner similar to all of the different coating processes.

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Applications for WS₂ Process DL-99

ArMS 120D and BB-3454 Type T

Successful high-speed cutting, dry-lubrication, impregnated applications. The product has been used for optimization on normal parts and unusual components parts where a friction-reducing coating under 0.0005” thick is required and where wear, galling, scoring and fretting need to be minimized, but seal usage is not limited in such applications.

Applications for MoS₂ Process DL-99

AMS 1256 and BB-3454 Type T

Successful high-speed cutting, dry-lubrication, impregnated applications. The product has been used for optimization on normal parts and unusual components.

MicroSurface Dry Lubrication Coatings Serve a Broad Range of Industries

The industry’s premier coating services. They’re unbeatable for n

Manifolds

Gaskets

Fuel injection systems

Fasteners, latches, pins, hinges

Fan components

Clamps, seats, seals, valves

Braking systems

Bearings and gears

Rollers

Riser systems

Pins, taps, machine tools

Nuts, bolts, thread protectors

Transmission plates and spacers

Storage tanks

Brakes

Reciprocating pumps

Solenoids

Pneumatic systems

Hooks and spheres

Screws and bolts

Sheetmetal

Typical WS₂/MoS₂ applications:

Braking systems

Spooling systems

Cylinders

Gears

Water, oil, solvent protection

Pumps, Gates, machine tools

Powertrain units

Power generation parts

Planes

Gates

Blue systems

Bending

Stainless steels

Carbon and stainless steels

Transmission gears and sprockets

Turbochargers

Wires and fibers

Serving many purposes—

To increase efficiency.

To increase manufacturing.

To increase friction, wear, power consumption

To increase operating temperatures.

To increase galling, fretting, drag.

To increase resistance when lubricants

For parts that are inaccessible.

To decrease overall process.

To decrease alignment problems.

To decrease loads exceeding of gear capacities.

To avoid affecting dirt and dust.

To reduce lubrication of high-precision pumps.

And much more.

Clamps, seats, seals, valves

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And much more.
Micro Surface – the specialists in dry lubrication coating

For many years Micro Surface Corporation has been the go-to resource for precision dry film lubrication coatings across numerous industries, including the heavy-duty performance profession. They’ve turned their expertise into a science – to the point of developing their own proprietary processes and coatings to perform.

**Focused and affordable**

Serving many purposes... for automotive, industrial, aerospace and aerospace applications, Micro Surface coatings are well-suited for parts requiring specific properties:  

- **Wear resistance**:  
  - Not required  
  - As required, not to exceed 310°F  
  - Not specified, similar to AMS 2526

- **Mineral oil**:  
  - Minimal, will delay corrosion

- **Corrosion**:  
  - Minimal, will delay corrosion

- **Metallic**:  
  - Not specified, similar to AMS 2526

- **Temperature**:  
  - Type I: 298 Minutes  
  - Type II: 500°F  
  - Type III: 1 Hr @ 400°F  or 2 Hr @ 302°F

- **Thickness**:  
  - Bluish gray, reflects substrate

- **Flat matte gray

Typical WS₂/MoS₂ applications:

- **Surface Protection**:  
  - Not required, similar to AMS 2526

- **Surface Compatibility**:  
  - Limited to such applications.

- **Surface Application**:  
  - Limited to such applications.

- **Surface Preparation**:  
  - Limited to such applications.

- **Surface Treatment**:  
  - Bluish gray, reflects substrate

- **Flat matte gray

**Micro Surface** is the industry’s premier provider of WS₂ and MoS₂ dry lubrication coating services. They’re unbeatable for quality, turnaround and affordability...
MW per Process SL-39

This coating is commercially available and in standard steel-sawing applications, in precision bearing and gears in secure applications as a semi-lubricant and in many industrial and automotive applications as a semi-lubricant. WS2 is also used as a wear-resistant additive in composites, cutting tools, etc. It has better surface properties and better operating temperature range. It is also albumin of the dry film lubricant and does not usually affect the precipitation of lubricants. It does not withstand abrasive environments and delays but does not prevent corrosion.

MoS2 per Process DL-99

Our dry lubricants can each offer slightly different advantages...