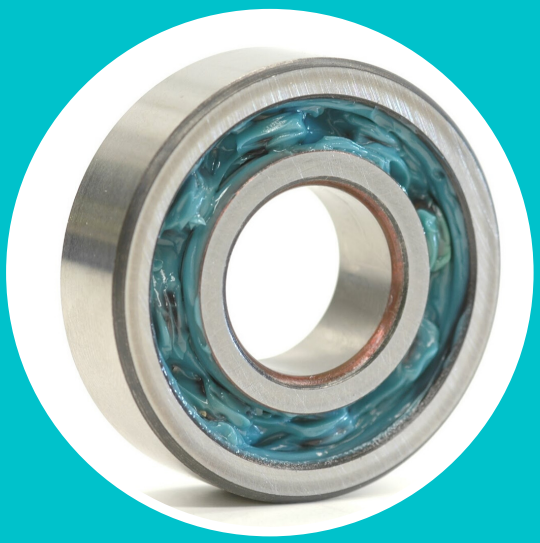
STUBBORN LUBRICANTS FOR TOUGH APPLICATION

MOSIL LUBRICANTS

SOLID LUBRICANTS



SOLID LUBRICANTS - UNIQUE LUBRICATION

Major challenge was faced by lubrication industry when it came for lubrication of military jet fighters and space application. Requirement of a better lubrication lead to development of unique form of lubrication using solid particles. These are now known as solid lubricants.

Industries usually have a myth that extreme conditions are uncommon in their plant. However usually every manufacturing plant has at least one application which can be termed as critical and extreme condition on the basis of lubrication viewpoint. Typical examples of extreme conditions are high or low shaft speeds, high pressures, high or low temperatures, atmospheric and process contaminants and hard to reach areas.

Lubricants provide effective lubrication when the surface area (metal to metal or metal to plastic or plastic to plastic etc.) come in contact and prevalent speed at that moment allows for effective formation of oil film and temperature range falls within the limit. The limit for lubricants are regardless of base oil type and usually its the condition that causes a change in state of the fluid that prohibits the formation of lubrication film.

Solid Lubricants are a unique way of lubrication that can protect interacting surfaces even after the wet lubricating film is lost. Materials usually used as solid lubricant are either discovered or created. These solid lubricants can be applied on the surface in the form of additive to fluid lubricants or in a pure form. The resultant film on the surface is characterized as dry film.

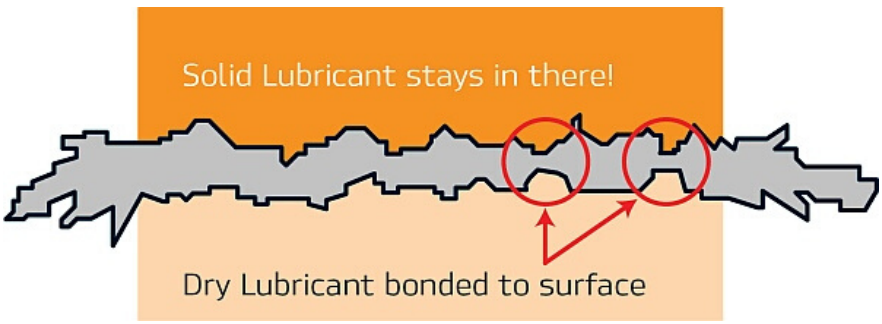
THE MOST COMMON TYPE OF THESE SOLID LUBRICANTS ARE :

- Molybdenum disulfide (MoS_2) - known as moly
- Polytetrafluoroethylene (PTFE) - known as teflon
- Graphite
- Boron nitride
- Talc
- Calcium fluoride
- Cerium fluoride
- Tungsten disulfide

Moly, Graphite and PTFE are most commonly used in lubrication industry. Moly and graphite are extracted from mined ore whereas PTFE was created by Dupoint chemical compnay and is manufactured by company for many purposes.

WHAT ARE SOLID LUBRICANTS ?

Solid lubricants have lamellar structure preventing direct contact between the two surface coming in contact even at extreme conditions. Graphite and moly are commonly used lubricants. Solid lubricants are used as additives to oils and greases. They can also be added or alloyed into the surface when the component is been manufactured.

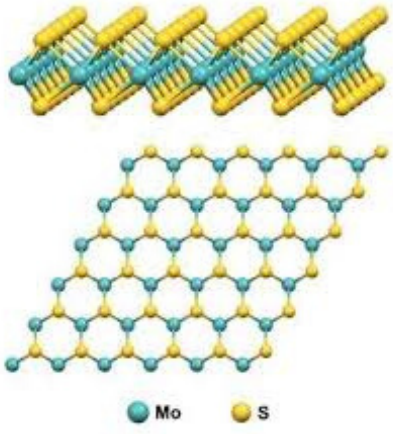


Properties of Solid lubricants :

Different Solid lubricants have different properties e.g. Lamella materials have good load carrying capacity in rolling and sliding mode, Graphite has high temperature capability and functions well in radiation atmospheres, Moly performs satisfactorily in hard vacuum and can tolerate higher loads better than graphite

Lets understand the commonly used solid lubricants that are Moly, Graphite and PTFE

- **Molybdenum Disulphide**



Mos2 occurs naturally in the form of thin solid veins within granite. It is purified form of the mineral molybdenite. It has hexagonal crystalline structure,. The total surface resistance is reduced among interacting surfaces thus reducing surface friction and resistance. Molybdenum disulfide is thermally stable in vacuum or inert environments, but in air or oxygen it begins to oxidize to MoO3 at approximately 4000C.

Benefits of molybdenum disulfide include :

- Adhesion is excellent
- Wide temperature range
- It protects against fretting corroison
- Friction is decreased with increasing load
- Load carrying capacity is high
- Stick - slip prevention

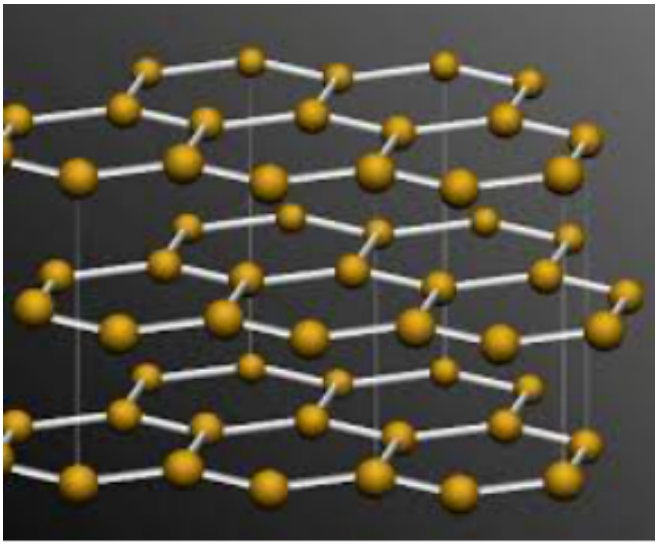
Limitations of molybdenum disulfide include :

- It is hydroscopic in nature, so it cannot be used in wet conditions as it increases friction
- Oxidation can cause corrosion
- Oxidation lower maximum temperature

Major application with Moly :

Automotive sector, rails, mining, construction, agriculture, military and aerospace.

- **Graphite**



Graphite occurs naturally in rocks such as marble, schist etc. It has properties of a metal and a non metal, which makes it opt for many industrial application. It is a layer lattice lamellar hexagonal structure. Graphite comprises of carbon and water vapour. It has excellent lubricating properties till the time moisture is available and will work satisfactorily upto temperature limit of 788°C.

Benefits of graphite includes :

- Excellent lubrication in humidity
- Protects against fretting corrosion
- Good temperature stability
- Low co-efficient of friction under high temperature

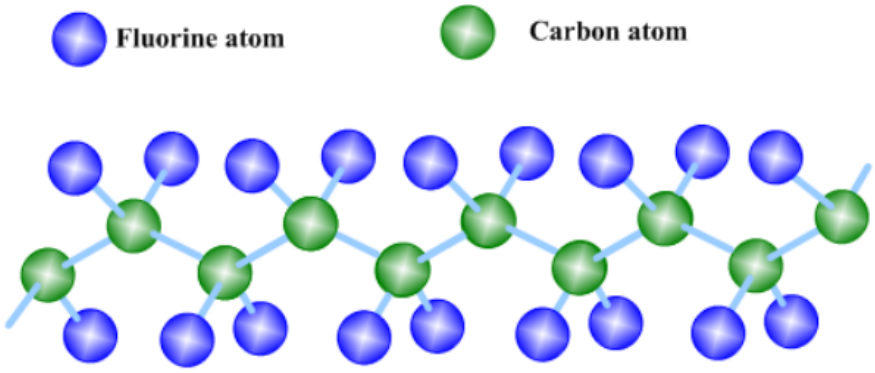
Limitations of graphite include :

- It can not be used in hard vacuum
- It can not provide lubricity in absence of moisture
- The oxidation product is Carbon dioxide which is hazardous to health

Major application with graphite:

Hot and cold forming, wire drawing and billet coatings, mold release for die cast, plastic and rubber mold, automotive engine and many common industrial applications.

- **Polytetrafluoroethylene (PTFE)**



Polytetrafluoroethylene (PTFE) molecule

PTFE constitute of carbon and fluorine atoms and are one of the most slippery materials since it has a very low surface tension. Unlike other solid lubricant, PTFE does not have layered structure. The molecules of PTFE slip along each other very easily similar to other lamellar structure. PTFE can be used upto temperature limit of 260 deg C.

Benefits of PTFE include :

- Good sliding - friction reduction
- Excellent chemical resistance
- Low load carrying capacity
- Low Co- effecient of friction at low loads
- Colorless lubricating film
- Chemically inert

Limitations of PTFE include :

- Low melting point
- Low thermal conductivity
- Load carrying properties is poor

Major application with PTFE:

Acts as coating in cookware, stain repellent for fabrics and textile industry, Chemical industry.

As we have understood properties , benefits and limitation of solid lubricants, It is important to understand where to use solid film lubricant.Since we have variety of solid materials with excellent lubricating properties. The most commonly used solid lubricants are mentioned above i.e Moly, graphite and PTFE.

MAJOR PROPERTIES TO BE CONSIDERED WHILE SELECTING SOLID FILM LUBRICANTS ARE

- Coefficient of friction
- Load - carrying capacity
- Corrosion resistivity
- Electrical conductivity
- Surrounding in which solid film lubricant has to perform
- Environmental factors such as temperature, pressure, humidity, oxygen content, radiation etc.

Pertaining to the solid lubricants benefits and limitation, we can use above mentioned solid lubricants For eg:

- Moly has highest load carrying capacity with low co- efficient of friction. But it starts oxidation at temperature of 400 deg c. It can be used in high load carrying capacity application but not recommended for use at high temperatures.
- Graphite can be used at high temperatures in oxidative atmospheres but it promote s galvanic corrosion and require moisture to exhibit its lubricating properties. It can be used at high temperatures but not recommended for use at high vacuum.

- PTFE is commonly used as anti - wear additives and perform well in presence of acids, bases and solvents. It can be used in application where acid resistivity is required and it can't be used at very high temperature and high loads.

MOSIL has varied range of greases, oils and anti - size in combination of the solid film lubricants as mentioned above and can be used depending upon the application in which it has to perform.