Dry/Solid Lubricant

Molybdenum Disulfide Powder

Molybdenum Disulfide is dry/solid lubricant powder, also known as the molybdenite (principal ore from which molybdenum metal is extracted), and has the chemical formula MoS_2. It is insoluble in water and dilute acids. Crystal structure is Hexagonal Lamellar and is similar to graphite, Boron Nitride and Tungsten Disulfide. It also has excellent film forming properties and is an excellent lubricant in moisture free environments below 400° C. MoS_2 offers excellent lubricity properties in inert atmospheres and under high vacuum where other conventional lubricants fail. MoS2 also offers extreme pressure lubricant properties. MoS_2 is able to withstand up to 250,000 p.s.i. which makes it extremely effective when used in applications such as cold metal forming.

MoS_2 is widely used as dry lubricant additive in Grease, Oils, Polymers, Paints and other coatings.

New and future applications of MoS_2: Since the discovery of single-layer graphene in 2004, the field of 2D materials has seen several new classes of materials emerge. One of these is transition metal dichalcogenides (TMD's). These materials are comprised of one of the transition metals bound with one of the elements in Group 16. However, oxides are typically not classed as dichalcogenides. Molybdenum Disulfide (MoS_2) is currently the most studied member of the TMD family. Similar to graphite, when MoS_2 transitions from a bulk structure to a single layer structure the properties of this material undergo a significant change. The layers of the TMD can be mechanically or chemically exfoliated to form nanosheets.

The most striking change that occurs when transitioning from bulk to single layer is the shift in the optoelectronic properties, with the material changing from being an indirect bandgap semiconductor with a bandgap value of approximately 1.3 eV to a direct bandgap semiconductor with a bandgap value of approximately 1.9 eV. Due to the presence of a bandgap in this material there are significantly more uses for MoS2 in comparison to other 2d materials such as graphene.

Some areas in which MoS_2 has already been applied include high on/off ratio field effect transistors due to low leakage currents, memresistors based on layered TMD films, controllable spin and valley polarization, geometric confinement of excitons, tuneable photoluminescence, the electrolysis of water, and photovoltaics/photodetectors.

Physical and Technical Properties

Properties	Molybdenum Disulfide (MoS_2) CAS No 1317-33-5
Colour	Blue- Silver Gray
Appearance	Crystalline Solid
Melting Point	1185°C decomposes
Density	5060 $Kg.m^{-3}$
Molecular Weight	160.08
Coefficient of Friction (COF)	
Thermal Stability in air	COF<0.1 @600° F (316° C) increases to 0.5 @ 1100° F (594°C)
Thermal Stability in argon	COF increases rapidly starting @800° F (426° C) COF >0.1 @ 900° F (482° C)
Load bearing ability	250,000 psi
Lubrication Temperature Range	Ambient: from -185°C to 350°C Vacuum: from -185°C to 1100°C
Chemical Durability	Inert Substance, Non-Toxic
Magnetism	Non-Magnetic
Corrosion Stability	
Coatable Substrates	Iron, Steel, Aluminum, Copper, other Metals, Plastics and Manmade Solids
Compatibility	Oil, Solvent, Paint, Fuel
Electronic / optoelectronic properties	HOMO / LUMO: HOMO = -6.39 eV; LUMO = -4.50 eV Bandgap: Eg = 1.89 eV Classification / Family: 2D semiconducting materials, monolayer materials, thin-layered transition-metal dichalcogenides (TMDs), n-type semiconductors

MoS_2 is available in particle sizes: 90 nm, 1.5 micron, 4.5 micron and 12.5 micron. Larger sizes are possible as custom orders.

Standard packing: 1 lb. plastic bag, 10 lbs. plastic bag and 25 Kg (55 lbs.) in small drum.

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