

Comparison between Molybdenum Disulfide (MoS₂) & Tungsten Disulfide (WS₂)

Tungsten Disulfide (WS₂) is one of the most lubricous materials known to science. With Coefficient of Friction at 0.03, it offers excellent dry lubricity unmatched to any other substance. It can also be used in high temperature and high pressure applications. It offers temperature resistance from -450° F (-270° C) to 1200° F (650° C) in normal atmosphere and from -305° F (-188° C) to 2400° F (1316° C) in Vacuum. Load bearing property of coated film is extremely high at 300,000 psi.

Tungsten Disulfide (WS₂) can be used instead of Molybdenum Disulfide (MoS₂) and Graphite in almost all applications, and even more. Molybdenum and Tungsten are from same chemical family. Tungsten is heavier and more stable. Molybdenum Disulfide (Also known as Moly Disulfide) till now has been extremely popular due to cheaper price, easier availability and strong and innovative marketing. Tungsten Disulfide is not new chemical and has been around as long as Moly, and is used extensively by NASA, military, aerospace and automotive industry.

Till few years ago, price was Tungsten Disulfide was almost 10 times that of Molybdenum Disulfide. But since then price of Molybdenum Disulfide has doubled every six months. Now the prices of both chemicals are within comparable range. Now, it makes more economic sense to use superior dry lubricant (Tungsten Disulfide) and improve the quality and competitiveness of final product.

Tungsten Disulfide offers excellent lubrication under extreme conditions of Load, Vacuum and Temperature. The properties below show that Tungsten Disulfide offers excellent thermal stability and oxidation resistance at higher temperatures. WS₂ has thermal stability advantage of 93°C (200°F) over MoS₂. Coefficient of Friction of WS₂ actually reduces at higher loads.

Physical and Technical Properties

Properties	Tungsten Disulfide (WS ₂) CAS No 12138-09-9	Molybdenum Disulfide (MoS ₂) CAS No 1317-33-5
Colour	Silver Gray	Blue- Silver Gray
Appearance	Crystalline Solid	Crystalline Solid
Melting Point	1250° C, 1260° C (decomposes)	1185°C decomposes
Boiling Point		450°C
Density	7500 Kg.m ⁻³	5060 Kg.m ⁻³
Molecular Weight	248	160.08
Coefficient of Friction (COF)	0.03 Dynamic; 0.07 Static	
Thermal Stability in air	COF <0.1 till 1100° F (594C)	COF<0.1 @600° F (316° C) increases to 0.5 @ 1100° F (594°C)
Thermal Stability in argon	COF <0.1 till 1500° F (815° C)	COF increases rapidly starting @800° F (426° C) COF >0.1 @ 900° F (482° C)
Load bearing ability	400,000 psi for coated film COF:0.044@ 20,000 psi COF reduces to 0.024 between 200,000 to 400,000 psi	250,000 psi
Lubrication Temperature Range	Ambient: from -273° C to 650° C Vacuum(10 ⁻¹⁴ Torr): from -188° C to 1316° C	Ambient: from -185°C to 350°C Vacuum: from -185°C to 1100°C
Chemical Durability	Inert Substance, Non-Toxic	Inert Substance, Non-Toxic
Magnetism	Non-Magnetic	Non-Magnetic

Electrical Properties	Has Semiconductor properties	
Rockwell Hardness	30 HRc	
Coating Film Thickness	0.5 micron	
Corrosion Stability	Can slow down the corrosion rate, but can not fully prevent substrate corrosion	
Coatable Substrates	Iron, Steel, Aluminum, Copper, other Metals, Plastics and Manmade Solids	Iron, Steel, Aluminum, Copper, other Metals, Plastics and Manmade Solids
Compatibility	Oil, Solvent, Paint, Fuel	Oil, Solvent, Paint, Fuel

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