

Category: Materials

Reference: 1070

Friction Reduction by DICRONITE® Dry Lubrication Technique

Introduction:

DICRONITE® dry lubrication is an advanced lubrication technique that produces a precision tightly bonded thin film. With this technique, friction can be reduced to a previously unrivalled minimum. The dry lubrication can prevent wear, reduce energy conversion into heat and allow for lubrication without contamination.

Space Origin:

DICRONITE dry lubrication technology, a proprietarily modified form of tungsten disulfide was originally developed in the early 1960s by NASA which used DICRONITE during the Mariner programme for lubrication on sliding and rotating surfaces.

DICRONITE continues to be used in multiple space-based applications, including NASA's Mars explorer rovers and the space shuttles. Further space applications are the coating of parts in satellites and the International Space Station ISS.



Ball bearings coated with the DICRONITE® technique

Description:

In the DICRONITE technique a pre-treated surface is bombarded with a specially modified lubricious particle (tungsten disulfide) which is implanted into the atomic grid structure. The process causes a molecular bond and thus a high adhesion to the surface. The process takes place at room temperature with high speeds in the presence of conditioned air as carrier medium. To enable the physical bonding of the dry film lubrication, the surface of the component to be coated is pre-treated to achieve an atomically clean structure free of oxides and impurities.

The dry lubrication film created with the DICRONITE technique has a layer thickness of approx. 0.5 μm . It prevents direct contact of the friction partner's metal surfaces and therefore acts like an oil film. Furthermore, the layer has an extremely low friction coefficient of $\mu = 0.030$ (only half as large as that of graphite with $\mu = 0.073$), thus preventing excessive friction, heating and wear caused by galling. Due to the manufacturing process, the coating becomes part of the surface and can only be removed by removing a portion of the substrate itself.

Due to the combination with other layers, such as CrN or CrC which offer high hardness and corrosion protection, surface properties can be realised that are independent of those of the base material. Thus, corrosion resistance, surface hardness and friction sensitivity can be neglected in the choice of the base material, since these requirements are covered by the coating.

Innovative Aspects:

- due to molecular bonding the dry lubrication layer is permanently fixed to the surface
- extremely low friction coefficient of $\mu = 0.030$
- the layer prevents the formation of deposits, offers less chances for adhesion and is therefore easier to clean
- the ultra-thin coating is applicable on all metallic surfaces and also suitable for high vacuum applications
- virtually no limit to the working temperature: with an operating range of $-188\text{ }^{\circ}\text{C}$ to $+538\text{ }^{\circ}\text{C}$ under normal atmosphere and $> +1300\text{ }^{\circ}\text{C}$ in vacuum, many applications can be covered

Application Area:

Among others, the offered technique is suited for applications in the fields of:

- engine and drive technology
- precision engineering
- ultra-high vacuum technology
- plastics processing
- optics
- clean room technology
- medical technology

Standards / certifications:

- RoHS compliant
- biocompatible per ISO-10993
- compliant with SAE AMS 2530 and DOD-L-85645C

Examples of components to be coated are:

- parts of injection moulding tools to minimise wear and to reduce the release energy of the mould
- joints, hinges, ball bearings and ball bearing guides (also if already mounted), engine and drive components in motor racing
- screws and other fastening elements made of critical materials (titanium, aluminium, VA)
- movable micro-components for precision instruments

Cooperation:

The company is interested in the execution of coatings on commission. The company is capable of coating components up to a size of 600 mm x 800 mm and a weight of 250 kg at short notice. The maximal length for linear guides is 3 m. Furthermore, new application areas can be developed in cooperation with other coating companies.