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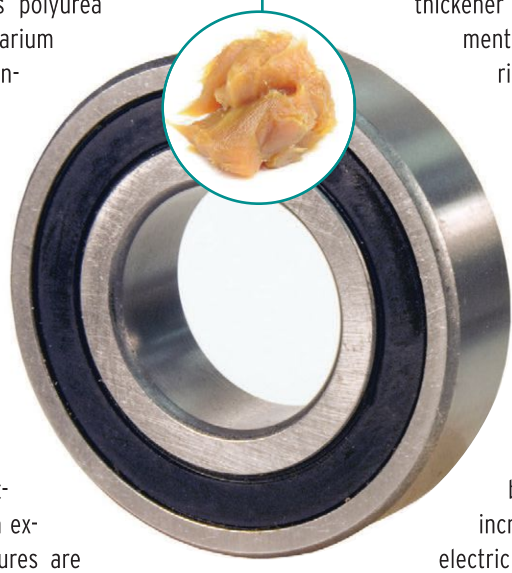
Polyurea Greases

A three-step process is used to manufacture these versatile and tough greases.

Polyurea greases are a preferred choice for filled-for-life applications in bearings and are important in steel plants and electric motors.

MANY TYPES OF THICKENERS are used in greases. The most popular greases are based on lithium, lithium complex, calcium or aluminium complex soap thickeners. In recent years, polyurea thickened greases have been gaining in importance, particularly in steel mill continuous castors, automotive wheel bearings, constant velocity joints, electrical instrumentation and auxiliary equipment bearings.

Polyurea thickeners were first introduced in 1954. At that time, attempts were made to develop a fibrous polyurea grease, primarily as a replacement for barium greases, which have health, safety and environmental problems related to the toxicity of barium compounds. Further development occurred in the 1970s, notably in Japan, and significant advances were made in the 1980s.



As these thickeners do not contain a metal soap, they are ashless. They are manufactured in a three-step process involving a polymerization reaction of different isocyanates and amines in either mineral or synthetic base oils. Depending on the performance required, aliphatic or aromatic amines or mixtures of both are used. With excess diisocyanate, three-dimensional structures are built along biuret-like bridges.

In the first step, between 9- and 20-wt% of the selected isocyanates and amines and about 40-wt% of base oils are loaded into a suitable reaction kettle. The blend is then slowly mixed at temperatures ranging from 21 C to 204 C for long enough to cause formation of the thickener. Although the reaction is exothermic, external heating is required to ensure completion and generation of a stable thickener complex. The NLGI grade of the thickener is predetermined by the amount of base oil introduced at the start.

In the second step, suitable liquids and solid additives are added to the hot thickener in the same kettle or in a finishing kettle. Portions of the remaining base oils are added to the thickener to achieve the desired viscosity grade and cool it to temperatures suitable for the addition of other performance additives. These additives include antioxidants, extreme pressure, antiwear agents and dyes. In the final step, the grease is homogenized to achieve the desired NLGI grade. Homogenizers are preferred over colloid mills since they generate polyurea greases with better texture and can significantly adjust the NLGI grade of the grease.

Recently, polyurea grease manufacture has been simplified by the use of commercially available polyurea powders. These powders are generated by solvent extraction of the base oil from the polyurea thickener formed in the first manufacturing step. The grease is then manufactured by solubilizing the powder at the desired concentration in base oils at medium temperatures with continuous mixing. Once formed, additional oil and performance additives are added to the thickener to achieve the desired performance requirements. This approach significantly eliminates the risks involved in handling the toxic raw materials but limits the types of polyurea greases that can be generated since this option is controlled by the composition of the powder.

Polyurea greases tend to have high temperature performance, inherent antioxidative properties, very good water resistance, good mechanical stability and can exhibit either high-shear stability or thixotropic behaviors. These properties have recently made them the preferred choice for filled-for-life applications in both bearings and constant velocity joints and have increased their importance in steel plants and electric motors. They are popular with engineers because they are perceived to be versatile and tough.

Polyurea thickened greases benefit from a drop point around 270 C. Their upper temperature limit is not determined so much by the stability of the thickener—the decomposition of which usually starts slightly below 250 C, as by the stability of the base oil. Therefore, these greases are superior to soap-based greases when the application temperatures exceed 180 C.

Some polyurea greases with proprietary extreme-pressure (EP) additive packages provide load-carrying capability without degrading the thermal stability of the grease at high temperatures. In the ASTM D3336 grease life test, these greases demonstrate an average life that is three to five times better than the high-temperature lubrication life of competitive multipurpose, lithium-based greases.

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