Viscosity Modifiers

Introduction

At Chevron Oronite, we foster a culture grounded in operational excellence and are conscientiously committed to protecting people and the environment. This product summary is one example of that commitment.

For engines to perform their everyday functions as well as expected, all their moving parts must be powered and protected with fuels and lubricants enhanced by some of the most technologically advanced additives. The products we produce help fuels and lubricants push the boundaries of speed, strength, cleanliness, and durability.

Generally speaking, the viscosity of any liquid is sensitive to temperature. As temperature increases, viscosity decreases (i.e., the liquid flows easier), and vice versa. This may result in reduced performance for engines that have to operate at extremely variable temperatures. The variability or stability of lubricating oil over a range of temperatures is measured by something called "viscosity index (VI)".

Viscosity modifiers are typically polymers (polymers are large chains of repeating chemical subunits). When a viscosity modifier is dissolved in oil, it takes on a coiled form, the size of which is dependent on the temperature. Consider viscosity modifiers as large, dissolved coils which

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can expand and contract. At low temperatures, the coil's energy is reduced and the coil becomes small. Its impact on the flowing oil is therefore less and its contribution to the oil's viscosity at low temperature is minimal. When the oil is heated, the coil expands. A larger coil volume impedes the free movement of the oil more than a small coil, which causes the observed increase in viscosity (i.e., the oil does not flow as easily). The thickening impact on the oil's viscosity at high temperatures is therefore greater than the impact at low temperatures, leading to the "Viscosity Index (VI) Improver" effect of a viscosity modifier.

Viscosity modifiers increase the ability of a lube oil to perform over a wide temperature range.

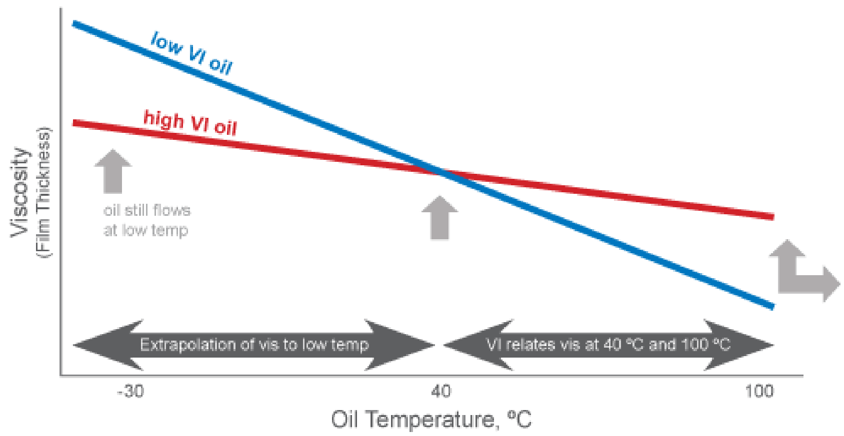

Figure 1. Oil Viscosity vs. Oil Temperature

Description and Properties

Viscosity Modifiers are usually ethylene/propylene copolymers which are long, flexible molecules used in the production of a diverse range of products, including electrical wire coating/insulation, automobile trim, roofing tiles, and lubricant additives. They are light colored solids at ambient temperature which can be melted with heating. They have little to no solubility in water and because they are less dense than water, will float in an aquatic environment.

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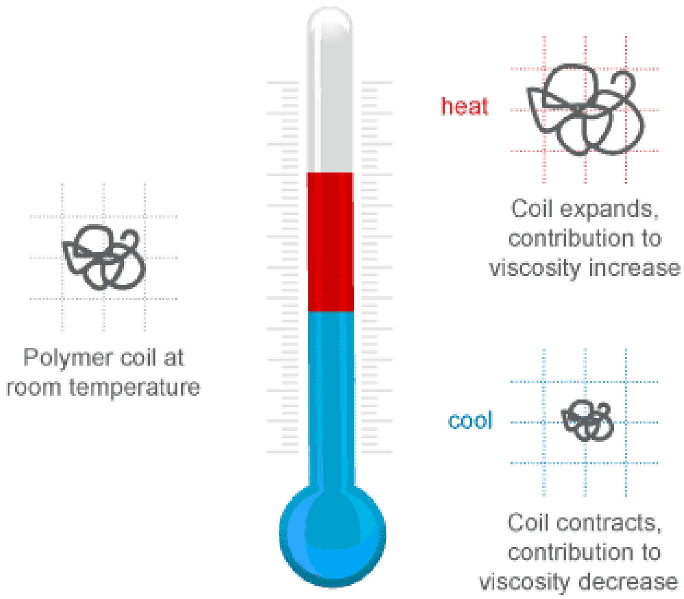

Figure 2. How a Viscosity Modifier's structure changes with temperature.

Long-term oral or dermal exposure to viscosity modifiers is not expected to cause any adverse or prolonged effects.

Health Information

Studies indicate that potential short-term exposure to viscosity modifiers by dermal and oral routes result in low toxicity by both routes of exposure. Vapors and fumes from thermal processing may be irritating to the eyes.

These solid materials are considered to be relatively inert and are not expected to cause any prolonged skin irritation, eye irritation, or skin sensitization.

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Test data support that these substances lack the potential to be toxic to the genetic material of the cell. Based on these studies, there is low concern that these substances can cause cancer.

Environmental Information

Viscosity modifiers are expected to persist in the environment but have very low toxicity due to low bioavailability. Degradation of viscosity modifiers is primarily by ultraviolet light and only occurs when exposed to sunlight. Since viscosity modifiers do not readily degrade, they are not expected to contaminate groundwater or produce harmful gases in a landfill. Since absorption is expected to be essentially non-existent, viscosity modifiers are not expected to bioaccumulate.

The Material Safety Data Sheets (MSDS) provided with these products contain suggested spill response and clean-up procedures. As appropriate (or required), report spills to local authorities. In the USA, the National Response Center can be reached at 1-800-424-8802 and CHEMTREC® at 1-800-424-9300.

Regulatory Information

Requirements may exist that govern the manufacture, importation, sale, transportation, use, and/or disposal of viscosity modifiers or products containing them. These requirements may vary by jurisdictions. For more information, consult the relevant Material Safety Data Sheets (MSDS) or contact us.

Exposure Potential

The low volatility and low water solubility of viscosity modifiers limits the potential for exposure, and therefore risk, to people in the workplace and consumers. Indirect exposure to these chemicals via the environment is likely to be negligible. Also, exposure to these substances outside of the workplace is likely to be low because they comprise only a fraction of the final lubricant oil product.

Dermal exposure to viscosity modifiers by consumers or employees is not expected to cause any adverse health effects. In work locations where viscosity modifier dust is generated (e.g., during manufacturing), lung effects may occur due to high level exposure to dust (if above the applicable OSHA Permissible Exposure Levels (PELs) for dust). Exposure to dust in the workplace is routinely below the OSHA PELs; respirators should be worn if needed. Emissions from the combustion or processing of viscosity modifier may cause health effects at high exposure levels; however, worker exposure can be adequately controlled using engineering controls and/or respirators.

Manufacturing of viscosity modifiers generally occurs in dedicated closed systems with proper engineering controls, thereby minimizing the potential for exposure. Solid waste is either incinerated or recycled and therefore there is no significant potential for release to the environment. Waste water is treated before release to a sewer or other appropriate system. Workers in manufacturing plants, including those in sample analysis, blending, maintenance, and cleaning are well trained in their particular operations and wear appropriate personal protection equipment, e.g. safety glasses and chemical resistant gloves.

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Professional mechanics, service station attendants, and other skilled workers that are frequently involved with oil changes use personal protective equipment and hygiene practices that reduce the potential for exposure to lubricant oils. Consumers have potential for exposure to small amounts of these substances due to the possibility of skin contact with fresh lubricant oils that can occur during crankcase oil changes or periodic oil "top off". There may also be infrequent, trivial inhalation exposure to aerosols/vapor if "top-off" is conducted before the engine has cooled. However, "do-it-yourself" consumer exposure is likely to be relatively infrequent. In summary, there is minimal potential for exposure to viscosity modifiers to the consumer commercial settings.

Chevron Oronite

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