

White Paper

Risks and Benefits of using **Peroxide-Cured EPDM** vs. **Sulfur-Cured Chloroprene (CR)** in Hose Applications

Peroxide-Cured EPDM (EPDM-P) vs. Sulfur-Cured Chloroprene (CR)

Executive Summary:

This white paper explores the risks and benefits of using peroxide-cured EPDM (EPDM-P) over sulfur-cured Chloroprene (CR) in hose applications. Specifically, it evaluates the impact of material selection on corrosion, ozone resistance, and overall performance in industrial environments. While CR is often used for its flame resistance and ease of formulation, its sulfur curing presents several risks, such as sulfidation and galvanic corrosion. In contrast, EPDM-P provides superior heat stability, chemical compatibility, and corrosion resistance, offering a safer and more reliable choice for hose covers and tubes.

Introduction:

In industrial applications, the selection of materials for hoses is critical for ensuring performance and longevity. CR and EPDM-P are both commonly used elastomers for hose covers due to their desirable properties. However, the curing methods of these materials—sulfur curing for Chloroprene and peroxide curing for EPDM—result in significant differences in their chemical behavior and performance characteristics. This white paper discusses these differences, focusing on the risks associated with sulfur-cured Chloroprene and the advantages of peroxide-cured EPDM.

Material Differences: Sulfur-Cured Chloroprene vs. Peroxide-Cured EPDM

1. Sulfur-Cured Chloroprene (CR):

Flame Resistance:

CR is often preferred for its flame-resistant properties, which are critical in certain industrial applications. However, its sulfur curing introduces certain challenges that need to be considered in high-performance environments.

Ozone Resistance:

While CR can be formulated to resist ozone degradation, the effectiveness of such additives can vary. Ozone exposure, especially from computer electronics and high-voltage environments, can lead to damage and degradation of the hose cover.

Corrosion Risks:

• Sulfidation Corrosion:

Sulfur-cured CR contains elemental sulfur that, when in contact with ferrous metals, can oxidize to form sulfur dioxide gas. This gas reacts with water vapor to produce sulfuric acid, which condenses on metal surfaces, leading to corrosion.

• Galvanic Corrosion:

When sulfur-cured CR, which is carbon black-filled (with low electrical resistivity), is in proximity to dissimilar metals, it can create a galvanic corrosion cell. In this case, the rubber may act as the cathode, leading to metal corrosion.

2. Peroxide-Cured EPDM:

Chemical and Physical Properties:

Peroxide curing, unlike sulfur curing, results in a more stable and chemically resistant elastomer. The saturated chemical backbone of EPDM, which consists only of alkane (C-C) bonds and lacks alkene (C=C) moieties, makes it highly resistant to ozone degradation, ensuring better long-term performance.

Ozone Resistance:

EPDM-P is naturally resistant to ozone due to its chemical structure, which provides superior resistance without the need for added additives. This makes it an ideal choice for environments where ozone exposure is prevalent.

Corrosion Resistance:

• Avoidance of Sulfidation Corrosion:

Peroxide cured EPDM does not contain elemental sulfur, making it immune to the sulfidation corrosion mechanism seen in sulfur-cured CR. This eliminates a key risk in metal-to-rubber contact scenarios.

• Superior Galvanic Corrosion Resistance:

Unlike CR, EPDM-P does not promote the formation of galvanic corrosion cells. Its electrical resistivity is higher, making it less likely to contribute to corrosion when in contact with dissimilar metals.

Additional Benefits of Peroxide-Cured EPDM:

• Improved Heat Stability:

EPDM-P offers 20-25% better heat stability compared to sulfur-cured CR, ensuring it maintains its properties in high-temperature environments.

• Expanded Chemical Compatibility:

EPDM-P is more chemically compatible with a wider range of substances, reducing the risk of material degradation in harsh industrial environments.

• Non-Staining Properties:

EPDM-P does not stain metal or PVC, providing a cleaner appearance and reducing the risk of damage to surrounding components.

• Improved Compression Set and Fatigue Resistance:

EPDM-P exhibits better compression set and superior elastomer fatigue resistance, extending the service life of hoses.

• Overall Performance:

EPDM-P's dynamic properties, including its superior fatigue resistance and mechanical performance, make it a more reliable choice for high-performance hose applications.

Conclusion:

While sulfur-cured Chloroprene (CR) offers flame resistance and other useful properties, its curing process introduces significant risks, particularly in terms of corrosion. The issues of sulfidation and galvanic corrosion can severely impact the longevity and performance of hoses in certain applications. Furthermore, CR's resistance to ozone degradation is limited by the effectiveness of added additives.

In contrast, peroxide-cured EPDM offers superior performance in key areas such as corrosion resistance, ozone resistance, heat stability, and chemical compatibility. It is a safer choice for hose applications, particularly when avoiding sulfidation and galvanic corrosion is critical. Based on these considerations, we recommend the use of peroxide-cured EPDM over sulfur-cured Chloroprene in hose applications to ensure better long-term performance and reliability.

References:

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This draft presents the technical comparisons and advantages of using peroxide-cured EPDM over sulfur-cured Chloroprene in hose applications. It can be further refined based on specific use cases or additional data, but it provides a comprehensive overview of the material differences and their implications in real-world applications.

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Go to www.danfoss.com for further product information.

Danfoss Power Solutions (US) Company

2800 East 13th Street
Ames, IA 50010, USA
Phone: +1 515 239 6000

Danfoss Power Solutions ApS

Nordborgvej 81
DK-6430 Nordborg, Denmark
Phone: +45 7488 2222

Danfoss Power Solutions GmbH & Co. OHG

Krokamp 35
D-24539 Neumünster, Germany
Phone: +49 4321 871 0

Danfoss Power Solutions Trading (Shanghai) Co. Ltd.

Building #22, No. 1000 Jin Hai Rd
Jin Qiao, Pudong New District
Shanghai, China 201206
Phone: +86 21 3418 5200