

An Overview of Bloom in Rubbers



Introduction

Bloom is a term used in the rubber industry to describe materials which migrate to the rubber surface and leave a visible witness.

The blooming of materials is a phenomenon that has been exploited by the rubber industry as a means of protecting rubber products from ozone attack. This phenomenon is of high practical importance to the rubber industry.

The purpose of this document is to develop an overview of the phenomenon.

Discussion

Blooming is caused by the migration of solid or liquid (for example, plasticiser) compounding materials which have limited solubility in rubber. The blooming phenomenon may often be assisted by elastic forces surrounding a compounding ingredient which tends to “squeeze out” a material from the rubber matrix. This latter mechanism is certainly responsible for wax blooming. Bloom includes dry and wet bloom. Blooming is usually described by terms such as “exudation”, “bleeding” or “oily bloom”. Blooming is a thermodynamic diffusion-controlled phenomenon and its rate is therefore influenced by thickness, area, time, concentration gradients, surface tension and temperature. Blooming in rubbers is often encouraged to confer protection against environmental attack. For instance, low melting point waxes are added to rubbers which slowly migrate to the surface to form a protective deposit or film against ozone attack.

Blooms may manifest in several ways:

- i. true blooms;
- ii. modified blooms (for instance, protective coatings);
- iii. pseudo blooms (surface degradation of rubber);
- iv. surface contamination;
- v. staining or discolouration;
- vi. hazing.

Some compounding ingredients after having bloomed to the surface of the rubber may change colour when exposed to direct sunlight or other environmental agencies.

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Blooming of crystalline substances

A substance in a rubber will bloom to the surface if it is added at a level that exceeds its solubility level. Generally, solubility is enhanced when temperatures are raised. This concentration gradient will drive the substance from within the bulk of the rubber to the surface. This process will terminate when a thermodynamic equilibrium is established.

Control of blooming

Most rubber compounds that are in contact with human tissue or used in food and drug applications are under the control of stringent regulations. Hence, rubbers designed for such applications are carefully formulated to ensure that substances that might be tentatively considered harmful are kept within benign levels. Hence, in such cases, blooming is entirely superficial. Blooming is a normal process and does not affect the properties or indeed the function of a rubber article. Thus, products in which blooming occurs normally function satisfactorily; and the phenomenon is purely cosmetic.

In Summary

- **Bloom is a designed in effect**
- **Bloom is caused by insoluble materials which migrate to the surface**
- **Stringent regulations exist to control these materials**
- **Bloom does not affect the performance of the rubber article**
- **In fact bloom helps protect your product against materials that could attack it**

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