



NIBA—The Belting Association
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Technical Article

Technical Article Content Pulled from the NIBA Belt Line Newsletter

Vulcanization (Part 2 of a 3-Part Series)

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The vulcanization or curing process occurs in three stages and each stage is of importance and so thus affects the service life of the finished product:

- (1) Induction or flow time
- (2) Crosslinking or rate of cure
- (3) Optimum state of cure or overcure

This Belt Line issue's section is about the second stage of the curing or vulcanization process.

Rate of Cure

The "rate of cure" is the rate at which crosslinking and thus the development of the stiffness (modulus) of the compound starts to occur after the flow time point. As the compound is heated past the flow time point, the properties of the compound start to change from a soft plastic state to a somewhat elastic state.

This crosslinking proceeds at a rate that is dependent on the cure temperature used and the compounding of the uncured rubber.

During the curing step, crosslinks are introduced which connect the long polymer chains of the rubber together. As more crosslinks are introduced, the polymer chains become more firmly connected and the stiffness or modulus of the compound increases.

The rate of cure is an important vulcanization parameter since it in part determines the time the compound must be cured, i.e., the "cure time." It also is an important parameter when mixing uncured compounds, such as splice materials. If two or three materials from different manufacturers are used and they all have different rates of cure, "deep" crosslinks will not be formed.

In many uncured compounds such as tire re-treading rubber, there is rate of cure known as the "popcorn cure" and in other compounds there is a rate known as the "long or slow cure." If mixing these compounds together such as adhesives, tie gums and cover gums all from different manufacturers, there is chance of a layered interface effect occurring.

In general, uncured compounds from different manufacturers should not be mixed unless proper testing has been done to ensure the necessary "deep" crosslinks are formed at the same rate.



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In the next issue we will look at the final state of cure or optimum state of cure (maximum stress value), and what happens if we dwell past that point.

Be sure to follow the uncured rubber manufacturer's curing tables for optimum cure temperatures, dwell times, and pressures.