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Liquid Farnesene Rubber Used in Car Tires for First Time

A Biologically Derived Liquid Rubber that Improves Ice Grip

February 20, 2017
Kuraray Co., Ltd.

Kuraray Co., Ltd. (Headquarters: Chiyoda-ku, Tokyo; President: Masaaki Ito; "Kuraray") today announces Sumitomo Rubber Industries, Ltd. has adopted liquid farnesene rubber (LFR) as a performance enhancing additive for use in the production of the latest studless tire WINTER MAXX 02. LFR is a liquid rubber developed by Kuraray using a new biologically derived diene monomer called farnesene, developed by Amyris, Inc. (Nasdaq:AMRS). This is the first time it is being used in tires.

Kuraray has discovered a variety of LFR's unique advantages and, going forward, will continue optimizing its molecular design to develop new applications that meet customers' diverse performance requirements, going beyond tires.

1. Background

- We concluded a joint-development agreement with U.S. biotechnology company Amyris, Inc. in 2011, and together created technology that refines Amyris's biomass material farnesene to a level of purity suitable for polymerization as well as technology that synthesizes LFR. We discovered relationships between various properties when combining LFR's molecular structure with rubber compounds and began supplying LFR to tire manufacturers. And, recently, following the success of this partnership, in December 2016, Kuraray and Amyris signed a multi-year collaboration extension, which includes joint marketing of products to industry and end customers.
- We specially designed the LFR used in the Sumitomo Rubber's latest studless tire WINTER MAXX 02. By combining the LFR with rubber compounds, we have improved the tire's ice grip performance at low temperatures while impeding the hardening of rubber compounds over time, thereby helping maintain the tire's performance.
- [News release about the launch of WINTER MAXX 02 tires \(Japanese only\)](#)

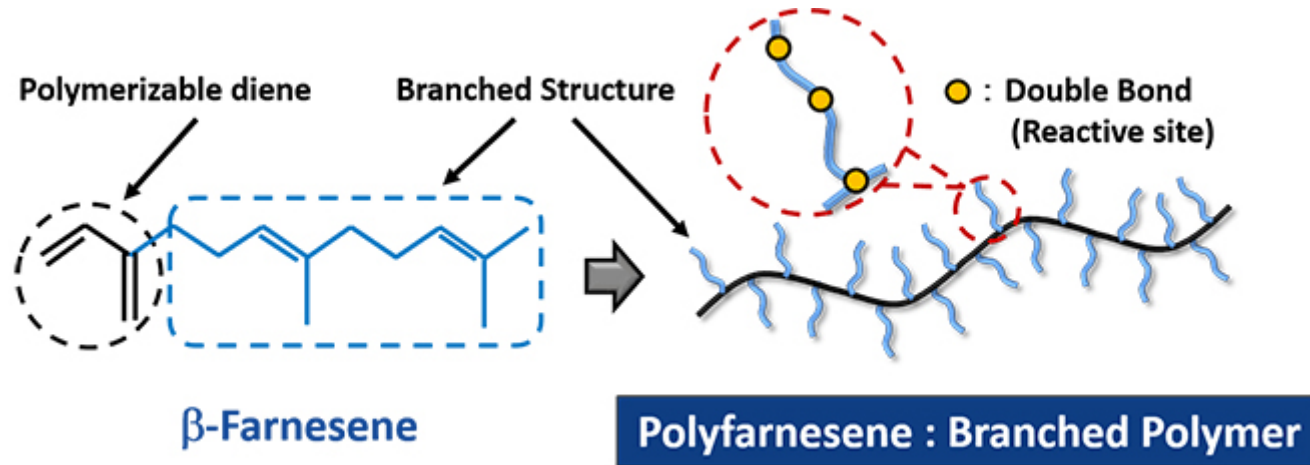


**WINTER
MAXX 02**

Images provided by Sumitomo Rubber Industries, Ltd.

2.LFR Features

- This proprietary liquid rubber uses farnesene manufactured from sugar cane using fermentation technology.
- The viscosity is much lower compared with current liquid isoprene rubber. When used as an additive in rubber compounds, it imparts high plasticity. In addition, it maintains excellent flexibility even at low temperatures and improves ice grip performance.
- Thanks to its optimal molecular weight, LFR reacts completely with solid rubber during vulcanization, meaning, unlike an oil, which would migrate to the rubber's surface over time and thus impede hardening, it stays bonded. Therefore, its ice grip performance is maintained over the long term.



LFR possesses a highly branched brush-like structure with molecular chains that do not easily become entangled with one another. In addition, a highly reactive double bond on the end of each branch ensures that, when vulcanized, LFR completely reacts with solid rubber and solidifies.

Reference:

About Amyris, Inc.

Amyris is the integrated renewable products company that is enabling the world's leading brands to achieve sustainable growth. Amyris applies its innovative bioscience solutions to convert plant sugars into hydrocarbon molecules and produce specialty ingredients and consumer products. The company is delivering its No Compromise[®] products across a number of markets, including specialty and performance chemicals, flavors and fragrances, cosmetics ingredients, pharmaceuticals, and nutraceuticals. More information about the company is available at www.amyris.com.

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