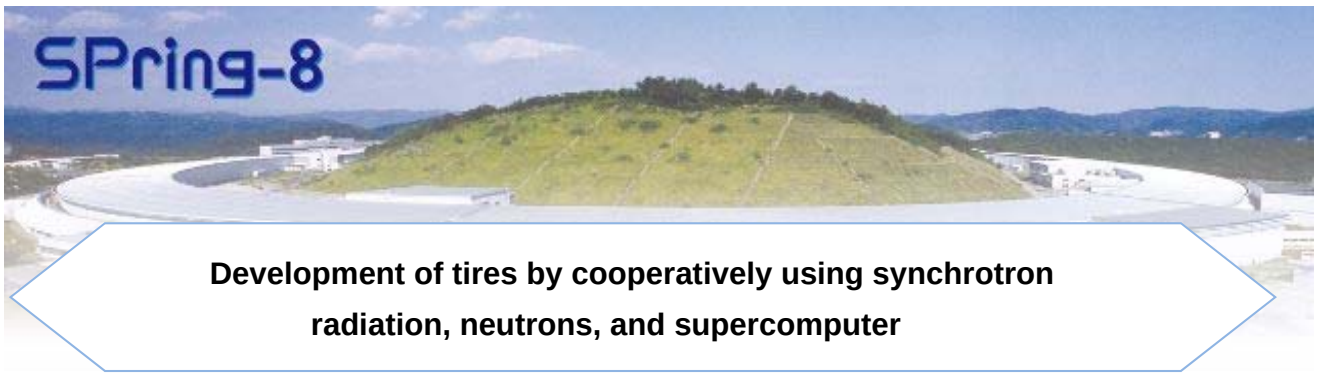

Development of tires by cooperatively using synchrotron radiation, neutrons, and supercomputer

Sumitomo Rubber Industries, Ltd. and its research group have promoted collaboration with SPring-8 (a large-scale synchrotron radiation facility) and Japan Proton Accelerator Research Complex (J-PARC, proton accelerators and experimental facilities that make use of high-intensity proton beams) using the K computer (a supercomputer) for the detailed analysis and computer simulation of the structure and behavior of the interior of rubber used for tires. By applying the research achievements accumulated thus far, they developed the "Advanced 4D Nano Design" technology, a technology for developing new materials that can realize a significant improvement in inherently contrary performance, i.e., fuel efficiency, wet grip, and wear resistance. By the adoption of the Stress Control Technology obtained using the above new technology, a concept tire called the "Wear-Resistant Max Tread Rubber Tire*" with a twofold-improved wear resistance was developed while maintaining the conventional fuel efficiency and wet grip.

The rubber used for tires consists of various materials, including nanoparticles such as silica and carbon black as reinforcing materials, and additives and cross-linkers to improve the functions, in addition to a skeleton polymer. A complicated layered structure is formed in multiple scales of time and space and the layers mutually interact, achieving high performance of the tires.

In this study, the technology to improve the performance of tires was established through the control of the structure and behavior of the polymer at the silica interface, the heterogeneity of sulfur cross-linking, the distribution of sulfur cross-linking lengths, and the behavior of silica networks by comprehensively combining the simulation results obtained using synchrotron radiation, neutrons, and a supercomputer.

*The tire is a concept tire and there is no plan to commercialize it, as of today.

(Max refers to the highest grade of tread rubber manufactured by Sumitomo Rubber Industries, Ltd.

Tread is the part of a tire that is in contact with the road.)