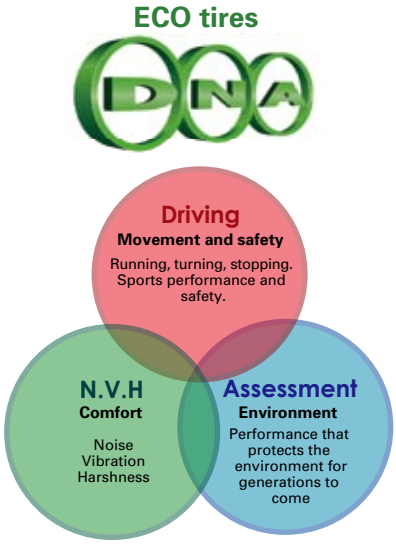
Tires

Yokohama Rubber has marketed “DNA” eco passenger car tires since 1998.

The three concepts behind the development of Yokohama Rubber tires



Continuing to change “in order not to change”

Toshihiko Suzuki
Director and Managing Corporate Officer
General Manger of Tire Technology Div.

Driving a car is intrinsically fun. We at Yokohama Rubber have always sought to make driving fun through our tire manufacturing. With the future of the global environment now viewed with concern, we believe that we must continue to change in order to maintain this unchanged stance. One solution is the DNA eco-tire series, which marries driving performance with environmental performance. Technology innovations since the launch of the first tire in the series a decade ago have seen the series evolve, and the latest tire, the DNA dB super E-spec, is made from 80% non-petroleum resources and features an orange oil compound and lightweight inner liner. We are constantly changing, never forgetting that it should be “fun to drive.”

DNA Earth-1 launched in February 2008 in Japan

Diverse Technologies for Realizing Environmental Performance

A lot of advnced technologies for raising the environmental performance of tires were employed to create the DNA dB super E-spec launched in July 2007 in Japan.

Combination of Low Fuel Consumption and Grip Due to Natural Rubber and Orange Oil

Lowering rolling resistance to improve fuel efficiency also weakens grip. By creating a new compound made from orange oil, however, Yokohama Rubber has succeeded in combining advanced performance in both respects. Orange oil has a similar molecular structure to rubber, and is characterized by the ease with which it can be mixed with oil and rubber. Applying juice from orange peel to a rubber balloon, for example, softens the area concerned and causes the balloon to burst. Injecting orange oil into the gaps between firmly intertwined polymers softens the movement of rubber. Using orange oil has thus made it possible to create a high-ratio compound with natural rubber. Natural rubber offers lower rolling resistance than synthetic rubber, but has the disadvantage that heat generation is lower and grip is poorer. The addition of orange oil, however, helps the rubber to adhere to even minute projections on the road surface, producing excellent grip.

Natural rubber + Plant-derived **orange oil**

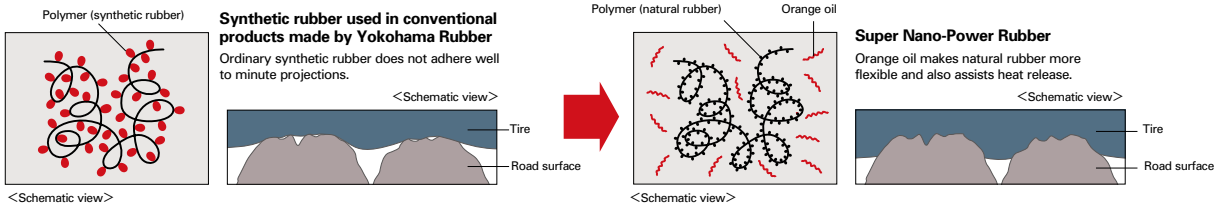
Lower rolling resistance and better wear resistance

1. Makes rubber more flexible
2. Accelerates heat release of rubber in action mode

Lower fuel consumption — **Grip**

Super Nano-Power Rubber

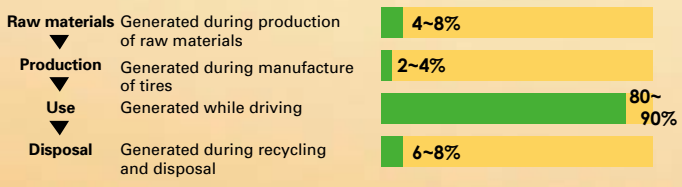
Rolling resistance slashed (20%)
while maintaining grip and wear resistance



Greater reductions in CO_2 Emissions Produced while Driving through LCA

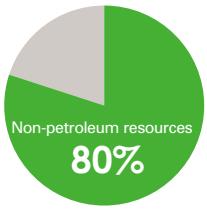
Lifecycle assessment (LCA) is a method of quantitatively measuring the impact of a product on the environment (in terms of CO_2 emissions) at each stage from production through to disposal. In the case of tires, CO_2 emissions during use account for 80-90% of emissions produced throughout the entire lifecycle, and so Yokohama Rubber is stepping up its efforts to improve fuel efficiency by lowering rolling resistance in particular.

CO_2 emissions during the tire lifecycle



**The above graphically represents approximate figures for tire products made by Yokohama Rubber.*

80% Made from Non-petroleum Resources



Switching to use of mainly non-petroleum raw materials has reduced dependence on finite petroleum resources. Care is taken to reduce CO_2 emissions throughout the tire lifecycle, from production of raw materials to disposal.

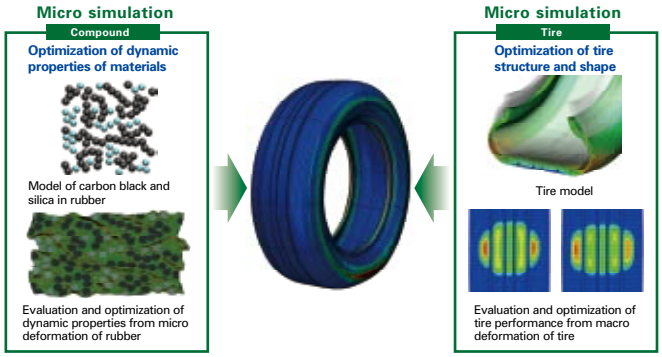
Made using mainly non-petroleum resources to reduce the burden on the environment

Synthetic rubber	Natural rubber
Petroleum-derived carbon	Coal-derived carbon
Petroleum-derived oil	Orange oil
Synthetic polyester fiber	Recycled rayon fiber

Optimization through Multi-scale Simulation

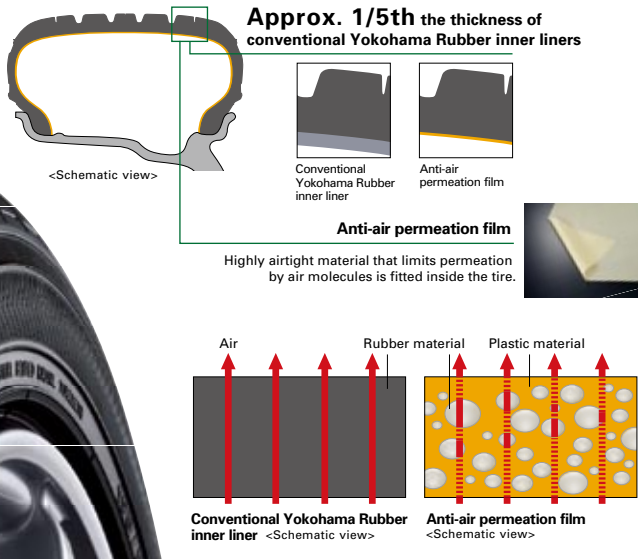
Multi-scale simulation is a technique for design evaluation from multiple perspectives, ranging from the macro level through to the nano scale. This technique makes it possible to analyze, for example, tire deformation during motion from the macro perspective of structure, while at the same time analyzing the deformation of carbon black and silica in compounds from a micro perspective. Taking full advantage of this technique, we are working to optimize tire performance and simultaneously reduce development times.

Application of multi-scale simulation technique (in case of DNA Earth-1)



New Anti-air Permeation Film Making Possible Drastically Reduced Weight

Using this new anti-air permeation film in the inner liner found inside tires reduces air pressure loss. As it is around one fifth of the thickness of conventional materials, it helps to reduce tire weight.



Eco-tires in All Genres

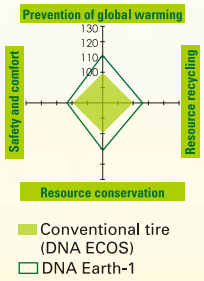
Passenger Car Tires

DNA Earth-1

Launched in February 2008 in Japan. 21% lower rolling resistance than conventional products (DNA ECOS) thanks to orange oil compound.

LCA: 8.782 per distance travelled (gCO_2/km/tire)

Assessment of environmental functions

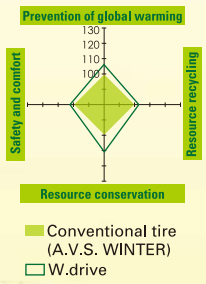


W.drive

This winter tire launched on the European market in September 2007 produces 7% less rolling resistance than conventional tires (A.V.S. WINTER).

LCA: 8.655 per distance travelled (gCO_2/km/tire)

Assessment of environmental functions

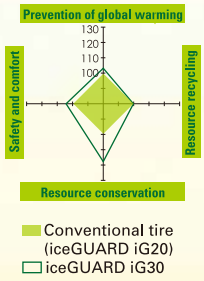


iceGUARD iG30 (dubbed "iceGUARD Triple")

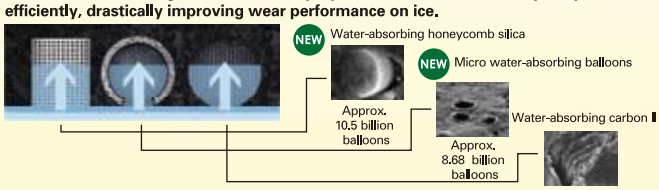
Launched in September 2008 in Japan. This studless passenger car tire is made from "triple water-absorbing rubber," which drastically improves wear performance on ice.

LCA: 8.910 per distance travelled (gCO_2/km/tire)

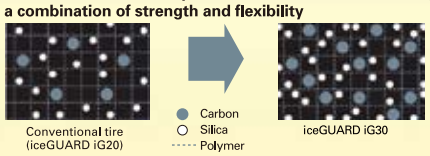
Assessment of environmental functions



Three water-absorbing materials are employed to absorb water more quickly and efficiently, drastically improving wear performance on ice.



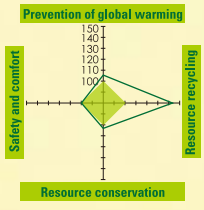
High-density compound of stiffener and soft rubber molecules that increase the density of the rubber structure, resulting in a combination of strength and flexibility



Aircraft Tires

Environmental performance has been improved by lowering weight and raising wear life. Aircraft tires are retreaded, making them outstanding from a recycling perspective.

Assessment of environmental functions



DNA Earth-1

Products Offering Improved Safety and Comfort

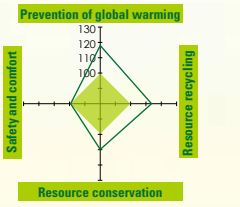
Truck and Bus Tires

ZEN 702ZE

Launched in April 2007 in Japan. Reusable as retreaded tires due to their longer casing life, improved wear resistance due to prolonged tread life, and better fuel efficiency thanks to reduced rolling resistance.

LCA: 271.3 per distance travelled (gCO_2/km/tire)

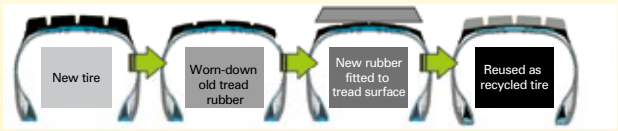
Assessment of environmental functions



Conventional tire (TY687)
ZEN 702ZE

The ZEN series is ideal for retreaded use

Retreaded tires are tires that have had new tread rubber fitted once the old tread has worn down. Due to their greater casing life, ZEN series tires make ideal casings for retreading.



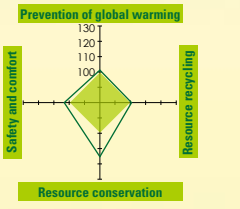
Light Truck Tires

PROFORCE STUDLESS SY01V

Launched in September 2007 in Japan. The main focus of design was on improving wear life for commercial use.

LCA: 6.063 per distance travelled (gCO_2/km/tire)

Assessment of environmental functions



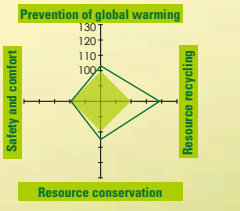
Conventional tire (SY900)
SY01V

Racing Tires

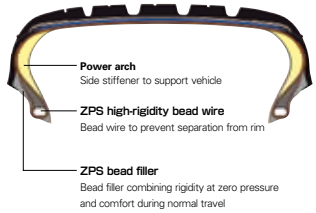
オレンジオイル配合

These newly developed racing tires were first used in race conditions in the Tokachi 24-hour endurance race held in Hokkaido in July 2008.

Assessment of environmental functions



Conventional tire
New products



"ADVAN Sport Z.P.S." side-reinforced run-flat tire

Run-flat Tire

ADVAN Sport Z.P.S.

Run-flat tires are tires that are designed to enable the vehicle to continue to travel a certain distance even when deflated due to a puncture. They consist of a strong stiffener in the side wall and high rigidity bead wire to prevent the tire from coming away from the rim (marketed in Japan only).

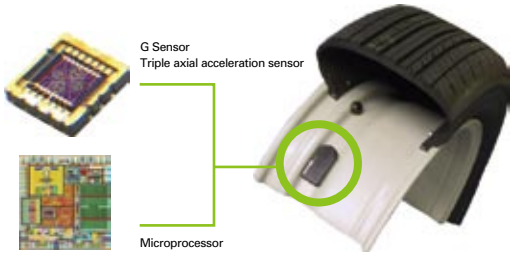
Air pressure Monitoring System

Yokohama Rubber is developing a system for monitoring air pressure in truck and bus tires called "HiTES." Sensors in the tires transmit data by radio wave, which is received by the system and displayed to the driver (marketed in Japan only).

HiTES display screen

"G Sensor" Vehicle Behavior Detection System

The G Sensor has sensors fitted directly in the tire (wheel), making it possible to detect lateral skidding more rapidly (marketed in Japan only).



G Sensor module installed in the wheel. Weighing only around 10g, it can withstand speeds of up to 300km.