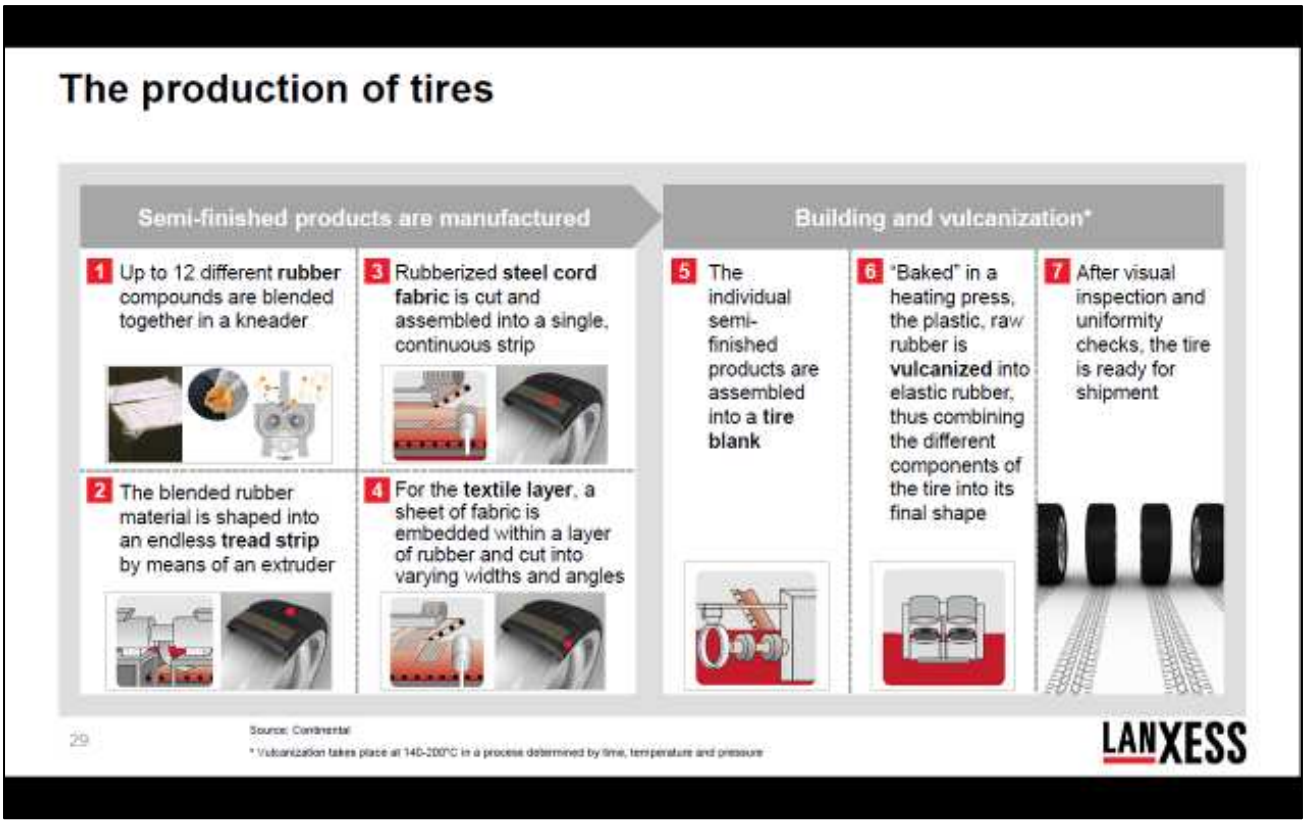
The Technology of ‘Green’ Tire

Even though the tire is one of the most engineered products and is considered by some as the last frontier of classical physics, it still remains a mystery like a ‘black-box’ to an average buyer. Not many know that the tires can influence many performance aspects of a vehicle like fuel efficiency, safety (braking distance and grip), handling and maneuverability, comfort, and noise, although a tire costs less than 1 percent of the vehicle cost. A tire supports the weight of the vehicle, absorbs shocks from the road, transmits the power to accelerate, brake and steer on the road and plays an important role in maintaining and changing direction.

Production of a tire

Tire is a highly complex component in an automobile that contributes significantly to the vehicle performance.



Tire Properties:

Fuel efficiency

Since tyres contribute to 20-30% of fuel consumption in an automobile, which means every fifth visit to a gas station is attributed to the tyre's rolling resistance. A high performance tire can improve the fuel efficiency of the vehicle by around 8-10% by minimizing the rolling resistance. This is a welcome respite for car users, given the rising fuel costs. Fuel efficiency depends on 'rolling resistance' of the tires, which in turn is proportional to the fuel consumption of the vehicle. When a car is wading its way through urban traffic or bad road conditions, the tire deforms to align itself to the road surface. This takes up energy transmitted by the engine and is manifested as rolling resistance. This then causes the car to consume more fuel and release more carbon emissions. It also causes tire abrasion which further pollutes through particulate matter and results in shorter life of the tire.

Each tire's footprint on the road, is only about the size of a postcard. The distribution of pressure across a tire's footprint differs depending on rolling speed. With increasing speed, the shape of the footprint changes from oval to square. At moderate speed, energy loss (in the form of heat) occurs primarily in the tire tread. At high speed, energy loss occurs primarily in the sidewalls and inner liner. Hence, the tire structure is key to the even distribution of vehicle load across the tire footprint.

High performance rubber in tires can reduce rolling resistance by about 20-30%. In addition, almost 25 percent of an automobile's carbon dioxide emissions are related to tires. Michelin, a major global tiremaker, estimates that about 4 percent of the world's carbon dioxide comes from rolling resistance from tires. So, fuel efficient tires are not only good for the consumer but are a boon for the environment as well.

Around 70% of the high performance rubber manufactured by LANXESS is used for the manufacture of low-rolling resistance tires. If all the vehicles in Europe were fitted with these energy-efficient tires, billions of liters of fuel could be saved each year.

Example: Assuming a car powered by a petrol engine has an average fuel efficiency of 10 Kms per liter, while running on standard tires. If we switch to high performance tires, the rolling resistance could be reduced by up to 30%, bringing a subsequent fuel relief as the fuel efficiency goes up to 10.5 kms per liter which means a saving of almost Rs

4,500 per annum assuming 1000 kms of running every month and reducing CO2 emissions by up to 12 kg per month

Safety

The second most important parameter that tires can influence is road safety. Tires made of high performance rubber show excellent performance in parameters such as traction, handling and wet grip. They guarantee a better grip on wet roads and thus a shorter braking distance than regular tires. A study conducted by Professor Horst WIldermann from Munich University in Germany estimates that high-quality tires improve road grip and handling and can reduce braking distance by 50 percent. Also, in 30 percent of all road accidents resulting in personal injuries, the collision speed and the severity of resulting injuries could be reduced with high-quality tires. In fact, roughly 5 percent of all accidents could be avoided with better tires, his report states.

Rolling Noise

Thirdly, high quality tires can also help reduce noise pollution. Road traffic noise components consist primarily of propulsion noise (engine, exhaust systems etc.) and rolling noise (tire-road interaction). Tires with innovative tread patterns and optimized rubber composites help to reduce rolling noise emission.

Structure and composition of a tire

Tire structure is key to the even distribution of vehicle load across the tire footprint. While more than 200 individual ingredients can go into a modern tire, most of them fall within one of the three categories that affect a tire’s performance profile - rubber (natural, synthetic), fillers (carbon black, silica, etc.) and additives (vulcanizing agents, vulcanizing accelerators, antioxidants, softeners, waxes for light protection, etc.) Today, the mix of natural (10-15%) and synthetic rubber (30-35%) accounts for roughly 40-50% of a modern passenger car tire. Nearly one-third of a passenger car tire consists of synthetic rubber.

In a tire, the tread, under tread, sidewall, carcass and inner liner are made of rubber and/or additives. Each part needs to have distinct physical properties to facilitate optimum performance. For example – the tread needs to be soft to provide grip and comfort and at the same time be robust to minimize tire abrasion. It contributes to more

than 50% of the rolling resistance of the tire. It should also ensure low heat build-up, while on road. While the carcass carries the weight of the car, the treads direct and transfer all forces generated by the vehicle. The sidewall must be able to change shape easily and should have high resistance to flex cracking and fatigue. It also protects carcass and influences fuel consumption. The inner liner must be particularly impermeable to air.

Some of the synthetic rubber polymers that a tire is made up of and their applications are:

- Polybutadiene Rubber (PBR) – It offers reduced heat build up, high abrasion resistance and improved fatigue properties. An advanced polymer namely Nd-PBR (Neodymium Polybutadiene Rubber) offers outstanding abrasion resistance, excellent strength and high crack resistance. The tread, sidewall and the carcass are made up of these polymers.
- Styrene-butadiene rubber (SSBR) - It offers excellent mechanical properties and moderate abrasion resistance. This polymer goes into the making of the tread. SSBR (along with NdPBR) helps to maintain an optimum balance of rolling resistance reduction, grip as well as durability.
- Butyl Rubber (IIR) – This rubber has good resistance to acids, hot water, moisture etc and is highly impermeable. Inner tubes for tires and the bladders used for manufacturing tires are usually made up of Butyl rubber. Innerliners of a tubeless tire and high performance inner tubes of tires are specifically made of Halo-Butyl Rubbers (HIIR)

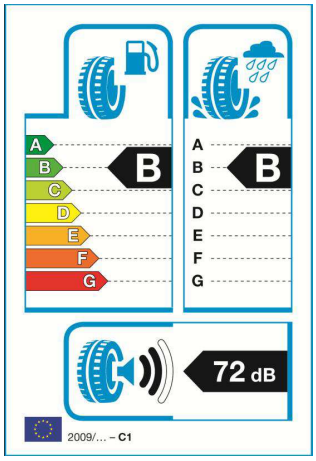
LANXESS synthetic rubber blends and additives are key ingredients that allow modern tires to improve performance, save fuel, enhance safety and last longer. LANXESS high performance rubber has a lower rolling resistance co-efficient and higher durability co-efficient as compared to standard rubber. Today, the mix of natural (14%) and synthetic rubber (27%) accounts for roughly 40% of a modern car passenger car tire's total components. Nearly one third of a passenger car tire consists of synthetic rubber. LANXESS has more than 100 years of experience in the development and production of synthetic rubber and rubber chemicals. Half of LANXESS' sales to the rubber industry are attributed to tire manufacturers. LANXESS is clearly focused on products for high performance and 'green' tires.

Additional Note on Tire labeling:

A label on a tire is something equivalent to the star ratings for the consumer durable, meant to indicate the performance of the tire in terms of parameters like fuel efficiency, braking distance, rolling resistance, rolling noise, durability, and so on through different grading systems.

From November 1, 2012, any tire sold within the European Union will have to have a sticker that shows its impact on the environment. Although the law comes into effect on November 1, any tire sold after July 1 will carry the label to give consumers a little time to get used to it. The European Union labels will address three areas – rolling resistance, wet grip and noise. The labels will indicate the values of these parameters, marked from 'A' to 'G', with 'A' being the most efficient.

South Korea and Japan has also instituted voluntary tire labeling in their countries.



Tire labeling aims to improve safety, ecological and economical efficiency of road traffic. The label informs consumers about key tire performance parameters like impact on fuel efficiency, impact on safety and that on external noise level.

This regulation will bring in consumer transparency and encourage manufacturers to move upwards on the value chain in terms of higher performance and 'greener' tires.

Cost-effectiveness of Green Tires

Consumers will benefit in the long run from better fuel economy, translating into savings at the petrol pump.

A calculation based on European usage: A car owner traveling 12,500 km per year could easily save up to €100 of fuel per year. The additional investment of €20 to €50 per tire amortizes within two years