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Airing a problem with tire safety and performance

Jeffrey Valentage, global tire market development manager at ExxonMobil Chemical, explores an often neglected element that ensures the long-term safety and performance of tires

How well do your tires hold air? You may be surprised at the lack of information available on such a critical, but basic, performance parameter for a tire. It is a fact that all radial tires lose air over time. Under laboratory conditions most commercial car tires lose 2-3% air pressure each month, but out on the roads and in hot climates, that pressure loss will be several times higher.

Does technology exist to reduce these losses? If so, what is its value?

In a 2014 report, the European Tyre and Rubber Manufacturers' Association (ETRMA) said that under-inflated tires can increase fuel-consumption by up to 4%, as they require extra energy to roll, and can raise CO₂ emissions by

as much as 5g for each kilometre driven. Under-inflation can also reduce tire lifespan by 45% and have a detrimental effect on braking distances.

Despite efforts to increase driver

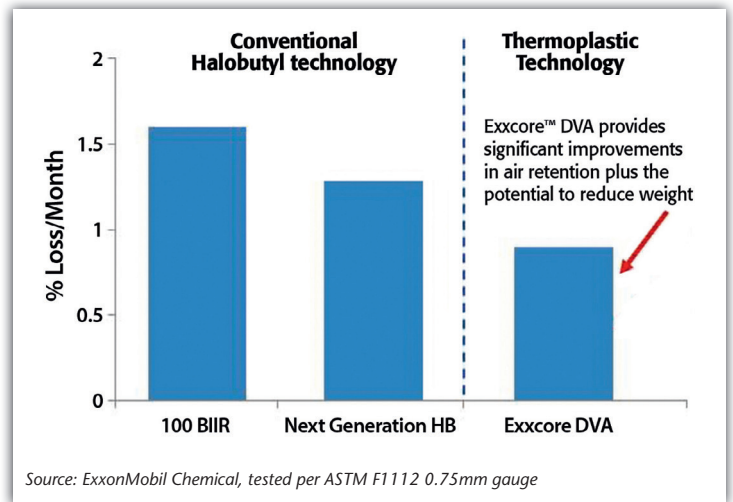
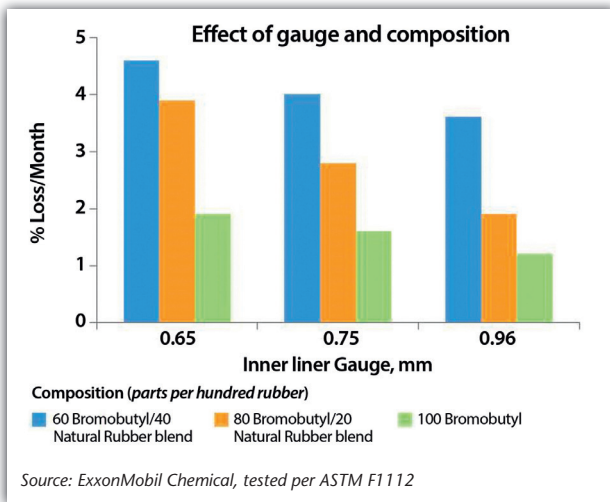


awareness, a more recent survey by ETRMA found that up to 80% of tires tested at the roadside in Europe were under-inflated, with 26% of vehicles having at least one tire under-inflated by more than 6psi.

So, while the tire industry has improved the average rolling resistance by 10% since 2010, these hard-won gains are lost as tires lose air pressure and drivers don't perform proper maintenance.

The introduction of regulations requiring the use of tire pressure monitoring systems (TPMS) on new vehicles was intended to provide the driver with a quick warning when there is a major loss of pressure.

This is typically set at -25%, which is a threshold well below that at which tire performance is



harmful. It can, therefore, be argued that TPMS has in fact driven further bad behaviour, as car owners are now checking their tires less frequently because they assume there is nothing wrong unless the TPMS warning light activates.

Maintaining pressure

The key to maintaining pressure in modern radial tires is the 'inner liner'. The tire's inner liner creates a barrier that prevents air-loss via permeation through the main rubber carcass. This inner liner is a thin layer of halobutyl rubber bonded to the inside of the tire – not to be confused with a tire 'inner tube' which is used on older tire designs and in parts of the

world where punctures are a regular event.

A 6psi pressure loss – which can be just a few months of driving – is enough to reduce performance on the EU tire labelling by at least one label category with fuel consumption and braking distances increased. And even more critical, air which is permeating into the carcass is doing long-term damage to the structure of the tire.

Despite the evidence, only two automotive OE companies have a formal specification on air-pressure retention and in the replacement market, all testing for tire labelling is on perfectly inflated tires.

Tire companies are working to

improve performance but also to reduce cost and weight.

Improvement in the performance of the inner liner is an invisible change to the consumer and, therefore, difficult to recover value directly, yet indirectly it may show up in tire and vehicle OE brand satisfaction scores.

Ultimately it could one day be recognised as a strong contributing factor to tire safety and the environment and be the subject of its own labelling category or a national standard.

In the meantime, drivers should continue to check the pressure in tires at least once a month, and when they buy tires ask the retailer: 'How well do these tires hold air?'

Inner liner development work with tire manufacturers

Simon Holmes, Saudi elastomers downstream development, explains how ExxonMobil Chemical is working with tire companies to achieve advance levels of air retention in inner liners using solutions based on the latest grades of halobutyl polymers:

The inner liner of a tire is typically based on halobutyl rubber blends and manufactured as a highly uniform sheet, in thicknesses of less than 1mm. Good control of the compound viscosity and process is required during manufacture to ensure the highest quality.

To test how well a tire holds air, the industry-recognised ASTM F1112 IPLR (inflation pressure loss rate) test method is used to measure the percentage of air loss per month.

This static test is conducted at 210°C in a temperature-controlled room, with the tire inflated to 2.4bar



or 35 psi and can be completed in as few as 42 days.

Great care has to be taken when mounting the tire and installing the valve stem. This is necessary to ensure a good seal to the rim, eliminating any possibility of air leaks.

Repeatability of these tests is very good, as long as equipment is well-maintained and calibrated and well defined testing and handling procedures are used.

A 100 phr halobutyl content can be more expensive – depending on the inner liner thickness requirements – and tends to be more difficult to process. However, some manufacturers are already adopting these materials in production tires today.

A 100phr bromobutyl content at around 1.0mm thickness is the basis for the current, best-in-class inner liners to obtain a consistent, below 1.75% IPLR. Though on-going work and testing continues, initial results of ExxonMobil's next generation of halobutyl polymers (a para-methylstyrene version of halobutyl) have achieved improvements of over 10% in permeability with a target of increasing this to around 20%.