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Future raw materials

Exciting new materials innovations are changing the way tires are made, and advanced testing tools are establishing whether they can withstand the modern world

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The tire industry is entering a new era. Sustainability targets, tighter regulations and shifting mobility needs are pushing material science in new directions. What was once thought of as 'just rubber' has evolved into a complex blend of chemistry, engineering and process expertise, all aimed at striking a balance between performance, safety and environmental responsibility.

Materials in tire performance

Every tire starts with its raw materials. Polymers, fillers, oils and additives determine how it grips, how long it lasts and how efficiently it rolls.

A typical passenger tire can contain more than 15 raw materials, including natural and synthetic rubbers, reinforcing fillers such as carbon black and silica, vulcanizing agents such as sulfur, and accelerators, plasticizers and antioxidants. The long-standing trade-off triangle between rolling resistance, wet traction and wear resistance remains the key challenge. The next generation of compounds must expand that triangle, combining durability with sustainability rather than sacrificing one for the other.

Figure 1: A Tack Tester for evaluating green tack during tire building, ensuring reliable component adhesion throughout assembly

Figure 2: The LAT100 for correlating viscoelastic properties with real-world performance, accelerating the development of low-rolling resistance, high-grip and high-wear-resistant materials

Bio-based and renewable inputs

Bio-based polymers and oils from renewable sources such as soy, castor, linseed and orange seeds are steadily replacing petroleum-based plasticizers. They don't just support sustainability goals; they can improve performance – for example, enhancing traction in winter tires.

Bio-based synthetic rubbers and functionalized liquid rubbers are also advancing, enhancing filler dispersion, improving processing efficiency and reducing the rolling resistance of the final product.

Fillers are evolving, too. Carbon black remains an effective reinforcing filler, but it comes at the cost of fossil fuel use and is produced through energy-intensive processes. To tackle this material shortcoming, recovered carbon black from the pyrolysis of end-of-life tires and circular carbon black produced through purification are now emerging as practical alternatives. Silica derived from rice husk ash and other agricultural waste streams is also attracting attention. Meanwhile, research into bio-based options, such as lignin – a natural polymer by-product of the pulp and paper industry – and microfibrillated cellulose (MFC) from plant fibers, is being undertaken. Hybrid systems that combine these bio-based fillers with silica appear particularly promising in striking a balance between performance and sustainability.