THE FUTURE TIRE & RUBBER AWARDS 2024

Recognising the most innovative, significant and inspiring developments from across the global industry

With the inaugural staging of the FTR Awards, one of our primary goals was to set down markers for identifying the most important and advanced developments being made by companies at the forefront of the tire & rubber industry.

The range of developments highlighted in their entries presented in *ERJ* July/Au-gust issue were chosen as best-case examples of the dynamic innovation programmes ongoing across our industries.

In selecting the top innovations in each category we have examined the relative merits of these projects in terms of the degree of innovation based on the information made available about each of the technologies involved.

We also looked for evidence of progress in terms of recent technical-development and/or commercialisation and – in the manufacturing categories – the ability to tap into advanced technologies, such as AI and machine-learning.

In the materials and product-design fields, meanwhile, a particular emphasis was on technologies that contributed most to meeting the ambitious decarbonisation goals of tire and rubber-product manufacturers.

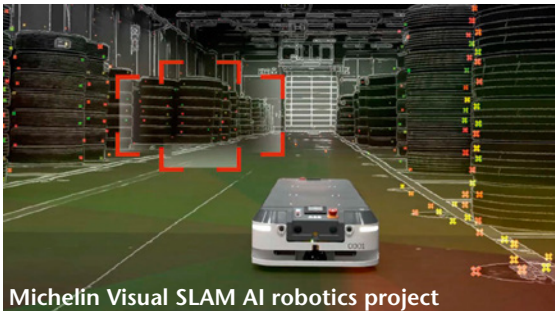
PLANT AUTOMATION

Advances in tire & rubber product manufacture

Michelin/ABB Robotics – AMR navigation

Joint winner: Michelin's project for the validation of ABB Robotics' new AI-based technology for smart factory applications, offers a vision of the tire factory of the not-too-distant future.

The French group's role in the trialling of the 'visual simultaneous localisation and mapping' (Visual SLAM) navigation technology for autonomous mobile robots (AMRs) shows the way forward for automation of tire manufacturing and supply-chain processes.


Michelin Visual SLAM AI robotics project

The project at one of the tire maker's facilities in Spain highlightsthe mapping & localisation capabilities of the technology as well as its application in various tire handling & transporting and production-flow applications.

In a large storage unit, the AMR is shown travelling through rows of stacked tires using a 3D map created from tracked features – highlighting the "unique" capacity of Visual SLAM to adapt to dynamic environments, supported by automatic updating of maps within the robotic fleet.

Using the AI-enabled navigation technology, the robots transfer of tires for inspection by two Michelin workers, to illustrate how the software enables "safe and easy human-AMR collaboration."

In production-flow examples, the AMR is shown moving wheeled trolleys carrying rolls of semi-finished materials to various items of production machinery at the Michelin facility. Positioning accuracy is stated to be +/- 5mm, while the AMR is said to have a maximum speed of 1.5m/s with a 2,000kg load.

VMI – Revolute

Joint winner: Having gained substantial market traction since its launch in 2022, the Revolute automatic bead apex assembly system represents a significant step forward for the Dutch group in its drive to fully automate tire-manufacturing processes.

The system is said to double the production speed, with cycle-times at around 4.3 seconds (depending on recipe-type), while enabling apex heights of up to 80 mm, a capability, says VMI, no

VMI Revolute robots

other machine currently offers.

Other features include recipe-driven settings, ability to handle challenging apex compounds, alongside features like automatic scrap removal/quality control and seamless automatic size-change capabilities.

The R&D team overcame technical challenges such as achieving speed changes with high accuracy and low cycle time, addressing potential tensions introduced in rubber materials at these speeds, accommodating a wider range of end-product specifications VMI noted in its FTR Awards submission.

SUSTAINABLE MANUFACTURING

Developments to manage and reduce scopes 1, 2, 3 emissions emissions

Winner: Siemens – SiGreen dynamic carbon footprint measurement tool

Among the main factors limiting the drive to sustainability in the tire manufacturing industry are complexity, changing legal regulations, lack of input from suppliers along the supply-chain

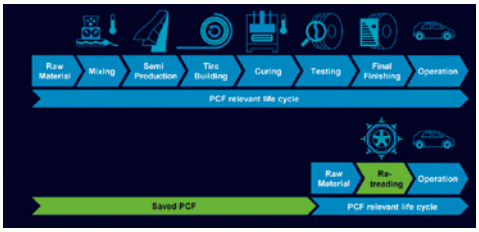
Siemens has responded to these challenges with the introduction of a management tool for dynamic product carbon footprint (PCF) management across tire manufacturing operations.

Called SiGreen, the system is designed to enable the industry to manage its PCF more effectively via a communication & reporting system that allows for frequent and pro-active updates of data – including quantifying improvements by suppliers.

Tire makers can, therefore, access dynamic PCF calculations that support target-setting and emissions-reduction measures with quantifiable results.

This provides "specific, dynamic and trustworthy PCF as a basis for data-driven decisions that accelerate decarbonisation in their own operations as well as their supply chains."

Going forward, Siemens said it aims to continuously develop SiGreen to track further ESG criteria, supporting product passports within the circular economy of the future.



Siemens SiGreen

SUSTAINABLE MATERIALS

Materials science developments that support decarbonisation

Joint winner: Nokian Tyres – Projects with UPM, Reselo

Nokian Tyres pioneering role in enhancing the sustainability of tire compound materials is evidenced by its partnerships with two other Scandinavian companies featured on the FTR Awards shortlist.

In July, the tire maker unveiled the first concept tire incorporating biomaterials producer UPM's BioMotion renewable functional fillers (RFFs) material – a lignin-based alternative for traditional carbon black.

In the Green Step Ligna concept tire all fossil carbon black in the sidewalls is replaced by the RFF, which UPM will produce at its new biochemicals biorefinery in Leuna, Germany

Nokian has registered a patent for using the RFF material in tire applications and is now licensing its patent to UPM, so enabling the supplier to provide the raw material to the tire industry.

"With the concept tire we demonstrate the usability of the groundbreaking new raw material in tires. Our concept tire marks a leap towards the use of renewable materials not only for us, but the whole tire industry," said Teemu Soini, VP, innovations & development at Nokian Tyres.

Nokian has also underscored its innovation credentials on several other projects, including a link-up

with Reselo Rubber, a Swedish developer of renewable rubber made from residue birch bark. The material was said to have shown its "versatility and future potential" including in ice-track testing on Nokian's White Hell facility in Finnish Lapland (See also news p10).

Joint winner: Synthos – Extending magic triangle with multi-functionalised S-SBR

A stand-out entry to the *ERJ* Elastomers for Sustainability programme, Synthos' Sprintan 918S is a multi-functionalised styrene butadiene rubber (S-SBR) said to offer a uniquely optimised balance of wet- and dry-braking performance, abrasion resistance and rolling resistance.

Since the initial introduction, Synthos has been actively developing the next generation S-SBR with further enhanced interaction between the polymer and surrounding filler particles towards

enabling continuous improvements in rolling resistance and enhanced wear performance.

Innovations include a proprietary functionalisation technology specifically developed for high-molecular weight oil-extended S-SBR. It is said to combine "outstanding elasticity at low frequency (correlated to rolling resistance) with exceptional wet grip performance and wear resistance, while providing processing characteristics

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comparable to a non-functionalised S-SBR."

The microstructure – level of styrene and vinyl groups – meanwhile has been optimised to enhance wet-braking performance at a comparatively low glass transition temperature, which in turn optimises wear performance.

Compared to typical non-functionalised, high-grip SSBR for passenger car summer treads, Sprintan 918S can deliver a 15% improvement in rolling resistance, as well as 8% better wet-grip stated Synthos.

ADVANCED DESIGN – TIRES

Breakthroughs in performance, safety and sustainability

Joint winner: Continental – UltraContact NXT

Combining a remarkably high share of sustainable materials with high-end levels of safety and performance, Continental's UltraContact NXT is a worthy contender for a top innovation award. With a share of up to 65% of renewable, recycled and mass balance certified materials, the tire is claimed to be the most sustainable production tire on the market to date. All 19 sizes available are said to carry the highest possible rating ('A') of the EU tire label in rolling resistance, wet braking, and exterior noise.

Joint winner: Pirelli – P Zero E

In this strongly contested category, Pirelli stood out in providing insights into the materials science and engineering that underpins the company's latest tire developments including the P-Zero E tire summer tire.

Impressively, the P-Zero E is said to be the first UHP tire made of more than 55% bio-based and recycled materials, while Pirelli says that at launch the complete range was awarded a 'triple A' rating on the EU tire label.

Among the innovative advances behind the P Zero E, *ERJ* has previously reported on Pirelli's development of patented process technology that overcomes the challenges of mixing lignin derived from pulp & paper industry waste into the rubber compounds.

The UHP tire also incorporates; circular carbon black from end-of-life tyres pyrolysis oil; bio-circular polymers made from monomers derived from used cooking oils or tire pyrolysis oil and bio-resin plasticisers deriving from vegetal biomass such as plant seeds or forest-based resins.

ADVANCED DESIGN – INDUSTRIAL PRODUCTS

Developments that offer breakthroughs in terms of product performance, safety and sustainability

Winner: ContiTech – Tough RuNR air springs

Continental AG's industrial rubber products business sector Conti|Tech has a strong track record in enhancing the capabilities of

rubber-based industrial products, with advances ranging from smart sensor-enabled hose and belts to the introduction of sustainable materials into its products.

With Tough RuNR air springs, ContiTech has significantly upgraded its materials compound for commercial vehicle air springs: using natural rubber enhanced with EPDM to replace conventionally used chloroprene rubber (CR).

In doing so, the carbon 'backpack' is said to have been reduced by more than 50% compared to conventional air springs, while improved product features enable the products to withstand a wider range of hot and cold climatic conditions.

Prior to this development, manufacturers had to choose between NR-based air springs which offer resistance to a very cold climate, or CR-based products that better withstand high temperatures, ozone conditions and UV exposure.

ContiTech's innovation, therefore, is impressive in combining materials science & engineering to enhance sustainability in such a demanding automotive vehicle application.

RESEARCH & DEVELOPMENT

Use of advanced laboratory and analysis techniques

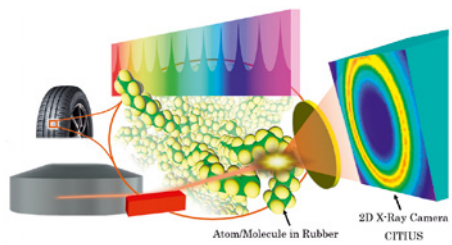
Winner: Sumitomo Rubber Industries – Synchrotron project

Sumitomo Rubber Industries (SRI) has long been a leader in the drive to better understand the behaviour of tire rubber by analysing the behaviour of polymers and other compound constituents on a microscopic level.

Through its latest advances in the field of 'synchrotron radiation' technology, SRI can now measure the motion of atoms, molecules, and nanostructures across a wide range of time domains.

The research programme, carried out in collaboration with Tohoku University, has involved the use of Japan's SPring-8 large synchrotron radiation facility.

Combined with the use of a special two-dimensional x-ray camera technology, SRI has been able to measure both the timescale of a 'moving object' and its spatial scale at the same time.



According to the company, these cutting-edge analysis techniques have made it possible to measure motions from 0.1 nanoseconds to 100 nanoseconds – compared to 10 to 1000 nanoseconds previously.

By being able to examine atomic/molecular motion in rubber more closely in the shorter time domain, SRI expects to advance the development of tires with high strength and "excellent" wear resistance.