

Elastomers for SUSTAINABILITY

ERJ AWARDS 2026

E4S Awards final voting results

Company	Location	Project title	Readers votes	Judges score (/200)	Total
UPM	Leuna, Germany	Renewable functional fillers	835	175	1,110
Asahi Kasei, Europe	Düsseldorf, Germany	Hydrogenated SBR to reduce 6PPD usage	700	180	880
Monolith (with Goodyear)	Lincoln, Nebraska / Akron, Ohio	Carbon black from plasma pyrolysis of hydrocarbons	660	170	830
Hankook, Hyosung, SK Chemical,	Seoul, South Korea	Advanced tire with chemically recycled PET	550	175	725
Cabot	Boston, Massachusetts	Evolve reinforcing carbons	505	150	655
Lanxess	Cologne, Germany	Anti-degradant to replace 6PPD	500	160	660
Michelin	Clermont-Ferrand, France	Sustainable tire cord adhesive	500	150	650
Evonik	Essen, Germany	Advanced rubber recycling formulation	300	160	460
HF	Hamburg, Germany	Smart final mix	250	155	405
Novolop	Menlo Park, California	Chemically upcycled TPU	200	160	360

UPM lignin filler project tops inaugural E4S Awards

Followed closely in reader/judges poll by Asahi Kasei and Monolith/Goodyear

UPM Biochemicals' project to establish the adoption the renewable functional fillers on a commercial scale has come out top of the Elastomers for Sustainability (E4S) Awards – recognising the technologies with the greatest potential to enhance the environmental profile of the tire and rubber manufacturing industries.

The Finnish group achieved scores of 835 from 156 responses readers' poll as well as 175/200 E4S judging panel: the combined score of 1,110 leaving UPM

ahead of project entries from Asahi Kasei and Monolith in second and third places respectively.

Since the early stages of the E4S programme, launched in 2022, UPM Biochemicals has steadily maintained a high ranking in the E4S Top 10 – supported by in-depth updates about its establishment of a €1.2-billion bio-refinery in Leuna, Germany and the commercialisation of renewable functional fillers (RFFs) to be produced at the facility.

Offering a bio-based alternative to carbon black and silica fillers in tires and rubber products, the RFFs have shown significant promise in R&D programmes at major tire and rubber OEs including for a concept tire launched by Nokian Tyres.

As previously reported, Nokian Tyre in 2024 announced the production of the first ever tire made with RFF: replacing 100% of the carbon black used in a sidewall application.

» CONTINUED ON PAGE 30

In late 2025, UPM reported that it had started production and sales of first commercial products from Leuna, having just before commissioned a core process for the industrial-scale hydrothermal breakdown of wood into sugar and lignin.

Underpinning its sustainability credentials, the Leuna plant sources “FSC- or PEFC-certified hardwood exclusively from sustainably managed regional forests,” the company stated.

“The certifications confirm that all wood-based feedstocks used in the biorefinery are sourced from sustainably managed forests and are fully traceable through credible third-party auditing schemes,” it noted. UPM has also reported detailed life cycle analysis data showing that 1mt of RFF is equivalent to a saving of almost -1.1 mt in CO2 footprint.

UPM will now build on its work to establish RFFs as replacements or part-replacements for carbon black and other rubber fillers in products including tires, automotive profiles, hoses, seals, footwear and flooring.

In its E4S submissions, the Finnish group reported that almost six supply agreements for 2025 volume had been finalised – with many other deals “under discussion and expected to close” by the end of last year.

Typifying comments attached to the voting for UPM Biochemicals was one from a reader stating: “With their brave and determined investment in Leuna they are making a big step for a Bio-EU.”



UPM is championing the introduction of lignin-based RFFs in the global tire & rubber industry

Another explained: “Lignin is the second most abundant biopolymer on earth and a key for our future bio-based

economy. However, it is still dramatically under-represented in our raw material landscape. With their biorefinery in Leuna, Germany, and the RFF, UPM are doing amazing and brave pioneering work for the whole lignin ecosystem.”

Asahi Kasei

Asahi Kasei Europe’s strong showing in the E4S Awards, reflects both the innovative polymer science behind its selectively hydrogenated styrene-butadiene rubber (HSBR), and progress with its commercialisation.

With enhanced ozone resistance, the HSBR is molecularly tailored to allow reduced usage of 6PPD in the tire/rubber compounds, thereby addressing concerns over the impact of the widely used antiozonant on the marine environment.

According to Asahi, studies have shown that the HSBR can also improve mechanical properties, including doubling fatigue resistance of polybutadiene blends with natural rubber.

A particular target application for the modified HSBR is the tire sidewall, the part of the tire that is most exposed to UV and ozone, thereby demanding exceptionally high ozone resistance – as well as being constantly subjected to cyclic stress (flexing) during driving.

Asahi reported that it is also working to further optimise the rolling resistance of the rubber and so deliver improved fuel efficiency.

Pointing to further sustainability benefits, Asahi said usage of the HSBR in the sidewall could eventually reduce the frequency & need of tire replacements due to degradation.

In terms of the commercial status, Asahi said the HSBR is “now being used and tested by many tire manufactures’ worldwide and has received positive feedback. Indeed, the polymer maker expects to establish commercial sales of the rubber in 2026.

E4S judges were impressed, one commenting: “Having developed a new catalyst to selectively reduce the double bonds present in SBR – so increasing ozone resistance and allowing reduced usage of 6PPD – Asahi’s focus has shifted to improving the mechanical properties. The chemistry can also double fatigue resistance in tire treads and could improve sidewall performance.”

Monolith/Goodyear

Monolith Materials’ project with Goodyear, titled ‘Carbon black from plasma pyrolysis of hydrocarbons’, was the most recently supplied entry to make it onto the E4S Awards shortlist. The carbon black produced from methane or other hydrocarbon is tailored to match the performance of furnace carbon black across different tire/rubber applications.

In its E4S submission, Monolith stated: “To our knowledge, this is the first ever plasma pyrolysis carbon black development to allow for drop-in performance compared to a furnace black in a diene.”

“Making a carbon black produced from a plasma pyrolysis process behave the same way in rubber matrices was a significant accomplishment, enabled by intentional design of colloidal

About the E4S Awards

Over the last year or so, the Elastomers for Sustainability (E4S) judging panel has worked hard to identify the projects most likely to enhance the environmental profile of the elastomers/rubber industry. Their expert analysis form the basis of the Top 10 E4S table published and updated in each issue of ERJ magazine.

Along with a poll of readers, which attracted over 150 responses, the E4S programme rankings has culminated in the selection of the top projects from a shortlist of candidate projects for the inaugural E4S Awards 2025.

The winning projects are, therefore, those expected – by ERJ readers and the independent E4S judging panel – to make the biggest contribution to enhancing the sustainability of the elastomers/rubber industry going forward.

properties and appropriate formulation adjustments," it added.

According to Monolith, the carbon black produced from plasma pyrolysis has a significantly lower carbon footprint than furnace carbon black. This, it said, is due to "the use of low emission electricity and the fact that there is no combustion taking place during the production of the carbon black."

Additionally, Monolith said its proprietary process delivers a yield of 95% - utilising almost 100% of the hydrocarbon molecule - a significant leap over conventional furnace black processes, which typically achieve 55-65% yield.

Monolith's pyrolysis technology does not use water as a quench in the production process, relying primarily on water only for cooling purposes and pelletization. Internal estimates suggest up to 40% less water usage compared to conventional carbon black production.

Separate to its E4S submission, in 2023 Monolith announced that Goodyear would use its carbon black in a new tread formulation for a UHP all-season passenger car tire, with particular focus on potential electric vehicle fitments.

Among the supporting comments for Monolith's project from voters was: "Carbon black is a fundamental product in the rubber industry, to replace furnace production process with a less energy-and water-demanding new process is an important step forward in our industry."

Hankook tire

For its highly innovative 'Advanced tire with chemically recycled PET', Hankook Tire & Technology in collaboration with SK Chemicals and Hyosung Advanced

E4S judging panel

The expert panel, which is coordinated by ERJ editor **Patrick Raleigh**, comprises:

Jirí Brejcha, head of Brejcha Rubber Consulting, and former materials development specialist at Trelleborg Wheel Systems, and before that Mitas, Prague, Czech Republic.

Prof James Busfield, professor of materials & national teaching fellow director of industrial engagement & head of the soft matter group, Queen Mary University of London.

Dr Thomas Griggs, PDRA sustainable rubber projects, Queen Mary University of London.

Adrian Lunney, experienced media professional for the UK and international polymer sectors, covering industries including medical, automotive and packaging as well as machinery, materials and processing technologies.

Materials developed an 'electric vehicle-exclusive' iON-branded tire with recycled PET from discarded plastics materials used in tire cords.

SK Chemicals provided chemical recycling technology to break down discarded PET, while Hyosung Advanced Materials has developed the high-strength recycled PET-based tire cords for the iON tires.

The new iON tire has a 45% sustainable material content and has recently passed the reliability verification by "a European automotive manufacturer", Hankook announced.

Judging comments: "Ambitious and forward thinking and great to see some cross-sectoral activity (eg packaging into tires) with the rPET element to the fore. Hopefully the chemical recycling will deliver the right purity of material content. Hopefully also the project can sustain steady and guaranteed supplies of the PET waste stream."

Carbon platform

Cabot Corp's Evolve technology platform is designed to deliver reinforcing carbons in three sustainability categories: Recovered carbon black from end-of-life tires; reinforcing carbons made from renewable materials; and reinforcing carbons made with a demonstrably reduced greenhouse gas footprint from decarbonisation technologies.

Among the Evolve products launched on the market are: Vulcan 7H-C circular reinforcing carbon and Sterling SO-RC110 circular reinforcing carbon.

Made from ISCC+ certified tire pyrolysis oil derived from ELTs, Vulcan 7H-C is said to deliver "optimal dispersibility and extrusion characteristics to rubber compounds and drop-in performance comparable to Vulcan 7H carbon black or ASTM N234 carbon black"

It is suitable for synthetic and natural rubber-based tire treads and industrial rubber products that require excellent wear resistance, such as conveyor belts, solid tires, and other applications that require high abrasion resistance.

Produced by a Cabot co-pelletisation technology, Sterling SO-RC110 is a semi-reinforcing material containing 10% recovered carbon material. It combines ISCC+ certified recovered carbon material with Sterling SO carbon black to deliver performance comparable to ASTM N550 carbon black.

It is also said to offer high levels of quality, consistency and processability in rubber compounds used in sidewalls

Asahi Kasei recognised for HSBR innovation and progress with commercialisation

» CONTINUED ON PAGE 32



and under-tread compounds in passenger car and light truck tires as well as industrial rubber products.

Cabot is also developing additional reinforcing carbon technologies recovered from ELT products, which “will offer reliable performance at industrial scale, enabling tire makers to use higher amounts of sustainable content in their tire designs.”

The other Top 10 E4S Awards projects were:

EVONIK

Project: Advanced rubber recycling formulation

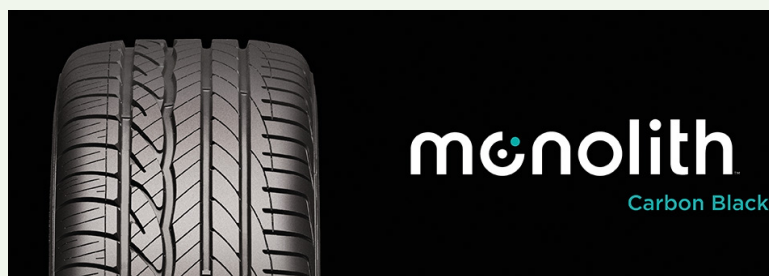
Essen, Germany-based Evonik AG has developed a process that enables the use of up to four times more recycled rubber in new tires than is possible with existing methods. The level of rubber recyclate incorporated into tires has been very limited up to now as the polymer structure hampers interaction with other materials, according to Evonik. In particular, it said, the sulphur bonds create a highly robust, three-dimensional network, which conventionally has an upper limit of about 5% when it comes to introducing ground tire rubber from end-of-life-tires into new tires.

[More details on E4S Awards online page](#)

HF Mixing Group

Project: Smart Final Mix

A special mention to HF as the only manufacturing technology company to make it onto the E4S Awards shortlist. According to HF, its AI-based algorithm Smart Final Mix is capable of optimising final mixing processes in the tire and technical rubber goods industries. By using the tool for optimising industrial processes, energy savings of up to 29 % could be achieved. As shown in a technical paper, within the algorithm, data on batch-temperature, energy-consumption and mixing-quality are linked to each other and then



Plasma pyrolysis process offers new route to sustainable carbon black

optimised. The technology, thereby, enables the optimal process-parameter settings that apply to the final-mixing process to be calculated.

[More details on E4S Awards online page](#)

Lanxess

Project: Rubber anti-degradant - alternative to 6-PPD

Lanxess topped the E4S table with its project to develop rubber anti-degradant, labelled Vulkanox 4060, which is said to offer an alternative to the use of 4-N- (4-methylpentan-2-yl)-1-N-phenylbenzene-1,4-diamine (6PPD) in tires. Developed to protect against oxygen, ozone and cracking, 6PPD is used in almost all commercial tires, especially in the tire sidewalls and the tread compounds. On reaction with oxygen and ozone in the environment, however, 6PPD can transform into 6PPD-quinone, found to be acutely toxic to coho salmon – possibly via entry of tire wear particles into aquatic environments. Based on lab results, Lanxess believes that Vulkanox 4060, which contains n,n'-dicyclohexyl-1,4-phenylene diamine is a potential 6PPD replacement.

[More details on E4S Awards online page](#)

Michelin ResiCare

Project: Sustainable tire cord adhesive

Michelin has started a drive to increase the uptake of ResiCare tire

cord reinforcement adhesive, which has been developed as a bio-based and non-toxic alternative to conventionally used RF (resorcinol-formaldehyde) products. Based on ‘araminolic’ resins – polymers synthesized from polyphenols and aromatic aldehydes–Michelin said the product “offers the same technical performance as historical resins and, over the past four years, has been commercialised within the tire industry.”

[More details on E4S Awards online page](#)

Novoloop

Project: Upcycled TPU elastomers

With its project titled ‘World’s first chemically upcycled thermoplastic polyurethane elastomers (TPU); Novoloop has ranked highly in the E4S Top 10 table. TPU feedstock is produced via the California start-up’s patented ATOD (accelerated thermal oxidative decomposition) process. Focused on chemically recycling polyethylene waste, the technology is said to offer a carbon footprint reduction of up to 91% when compared to the conventional process of producing adipic acid feedstock. TPUs produced via Novoloop’s patented process have already found a number of promising applications. Novoloop has also made significant progress with production and TPU manufacturing partnerships in India and China respectively.

[More details on E4S Awards online page](#)

Readers poll

From the 156 readers responses, votes were graded as follows:

A: Votes by readers independent of the project, also including supporting comments (Score 100)

B: Votes by readers independent of the project, without supporting comments (Score 50)

C: Votes by readers connected with projects with supporting comments (Score 20)

D: Votes by readers connected with projects without supporting comments (Score 5)

