The top entries for the inaugural staging of ERJ’s new Elastomers for Sustainability initiative has now been decided by our judging panel* led by experts in the field of polymer science & technology.

E4S is an industry-first sustainability initiative, designed to highlight significant advances for end-user sectors including tires, automotive components, construction, consumer, industrial and medical.

1. Asahi Kasei / New-generation styrene-butadiene rubber

The company’s sixth generation functionalised SBR is said to show 20% lower rolling resistance than previous versions and reduced wear. For this, Asahi developed a special functional group to enhance filler-polymer interaction – to improve wear resistance and rolling resistance – and a new polymerisation technology to optimise the polymer structure for advanced abrasion resistance while maintaining processability. The advanced SBR is currently being tested by customers worldwide, with plans to commercialise some grades in 2021. Next target is to improve the wear resistance by a further 20% and to increase the stability of the polymer in the compound.

**JUDGING REMARKS:**
- Top marks for rolling-resistance and wear reduction through functionalisation of SBR to stick to rubber molecules.
- Market-oriented development. What is positive is the progress being made in this vital area.

2. ETB / Bio-butadiene for tire production

The project targets the construction of standalone bioethanol-to-butadiene plants and those integrated into fossil-based butadiene production sites. To deliver this, the team developed a new catalyst system to increase the energy-efficiency and bio-butadiene yield of the Lebedev process. The result could be a significant enhancement of sustainability indices across the synthetic rubber production chain – with clear benefits also for the ethanol industry. Commercialisation steps include a demo plant in The Netherlands, with first commercial scale batches expected within three years.

**JUDGING REMARKS:**
- Ethanol-to-butadiene via updated, lower-energy Lebedev process – with a more efficient catalyst than before.
- A process development based on very good chemistry. With large-scale application could be beneficial for industry.

3. Trinseo / Highly-functionalised SSBR grade

Functionalised SSBR with enhanced filler-polymer interaction is now the way to go for tire tread rubber. New grade Sprintan 918S featuring Trinseo’s proprietary functionalisation technology is at the leading-edge: offering advanced wet-grip and rolling-resistance properties in tires, including those for electric vehicles (EVs). With Sprintan 918S, the optimised styrene/vinyl-group microstructure – in combination with functionalisation – is said to enhance wet braking performance at a relatively low glass transition temperature. This, in turn, im-
proves wear performance. Since its recent introduction to the market, the material is said to be generating strong interest for EVs, UUHP/UHP summer, all-season and even winter tread applications.

3 Tyromer / Tire-tire recycling

PR: While devulcanisation has long been the ‘holy grail’ for rubber recycling, it remains a challenge to achieve properties anywhere close to those of virgin polymer. This project uses twin-screw extrusion to carefully process ELT rubber crumb and other waste rubber – with encouraging results. Since 2016, a facility within AirBoss Rubber Solutions has supplied ‘tire-derived polymer’ (TDP) to KAL Tire. The client has used it in an OTR retread compound with 20% content, as well as OTR, truck and passenger tires with 15-20% TDP. Products are currently on road trials in N. America and Europe while a car tire maker is optimising compound with 30% TDP. A second TDP facility is nearing completion in Windsor, Ontario to supply a top American brand. With financial support from the Dutch government, a third TDP plant is being built in The Netherlands to supply a top brand in the EU. Further plants are planned worldwide.

JUDGING REMARKS:
• If it really works the way it is presented, the innovative power is very high.
• Project using simple process. Some questions in the applications area and about the next development steps

4 Continental / Eco-rubber garden hose

The strength of this project-entry is that it has delivered a pipeline taking a bio-ethylene monomer from sugar cane to a fully commercial product. The R&D work involved led to Arlanxeo’s development of an optimised bio-EPDM compounds able to match the performance of conventional petroleum-derived polymer. The garden-hose project is linked to a broader programme at Continental; targeting similar products containing up to 95% of renewable and reclaimed/ recycled feedstock and materials – including that from end-of-life tires and other rubber products.

JUDGING REMARKS:
• Commercialisation is key to achieving results in sustainability. This project seems to succeed in this point
• Sugar cane to EPDM rubber is really an Arlanxeo innovation. I like the potential in many other applications.

5 Covestro / Sports flooring based on CO2

This project stems from Covestro’s development – with partner RWTH Aachen – of a process for CO2 utilisation in polymers, which is said to save up to 20% of crude oil in production. Here, a CO2-based polylol enabled sport surfacing maker Polytan to create a sustainable binder for hockey pitches. This replaced an oil-based binder for the artificial turf, which typically contains an elastic underfloor comprising recycled styrene-butadiene rubber granules. The first successful installation was at the CHTC hockey club in Krefeld, Germany, a venue for international matches. Polytan’s sports flooring employing the CO2-based binder is now sold and installed globally. The next goal is to apply the CO2 technology to the artificial turf backing, thereby making the entire flooring system even more sustainable.

JUDGING REMARKS:
• A smart project, about using less crude oil and integrates CO2 into the production process. Extension beyond binders would be a good achievement
• Covers a complete value chain, plus the innovative use of CO2 as a polymer feedstock.

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E4S JUDGING
The expert panel comprised:
Prof James Busfield, professor of materials &
national teaching fellow director of industrial en-
gagement & head of the soft matter group, Queen
Mary University of London.
Dr Christoph Sokolowski, lead on sustainability is-
ues within the German rub-
ber industry association the
WDB (Wirtschaftsverband
der deutschen Kautschukin-
dustrie), based in Frankfurt
am Main, Germany.
Martyn Bennett, who has recently founded
UK-based consultancy
Midsomer Science, after a career spanning over 30
years at Avon Rubber plc,
most recently as chief sci-
entist and head of its AR-
TIS consultancy service.
Jiří Brejcha, head of
Brejcha Rubber Consult-
ing, and former materials
development specialist at
Trelleborg Wheel Systems,
and before that Mitas,
Prague, Czech Republic.

6  Behn Meyer /  
Epoxidised NR filler  
technology
This project addresses two impor-
tant aspects of sustainability: the
replacement of fossil-based materi-
als in tires and rubber products; and
reducing abrasion and, thereby,
the potential contribution of tires
to 'micropollution' pollution. This is
achieved via a process technology
that overcomes the challenges of
incorporating silica-silane systems
in epoxidised natural rubber com-
ounds. While work to commercial-
ise the technology is still ongoing,
the R&D effort and findings to date
represent a potentially significant
step towards that important goal.

JUDGING REMARKS:
• Part of their long-term develop-
ment around extending the use of
sustainable materials. Background
of the project is very well prepared.
Good combination of materials and
processes.
• ENR incorporating silica – an older
story than other submissions.

7  Cabot Corp. /  
Engineered elastomer
composites
Cabot has applied some signifi-
cantly innovative mixing technol-
ogy to provide rubber compounds
for tire and non-tire rubber ap-
lications. The patented mixing
process results in three times less
undispersed carbon black in rub-
ber compounds than conventional
mixing methods. The enhanced
levels of filler dispersion are said
to improve the performance, safety
and lifespan of tires, while reduc-
ing the environmental impact of
production. Stated improvements
in rubber properties include: 20%
lower hysteresis, 25% higher rein-
forcement, delayed crack initiation
and 70% slower crack growth.
Off-road tires – already being
commercially used in the mining
industry – are a particular focus
with potential for fuel-efficient on-
road tires also being explored.

JUDGING REMARKS:
• Very good process, using experience
of previous work and patents. Clear
strategy, clear impact.

8  Flinders University /  
Self-repairing rubber
Tapping the ability of certain rub-
ber materials to self-repair is an in-
triguing area of polymer research,
with particular implications for re-
use and recycling. This Australian
research team has focused in on a
specially developed polymer based
on sulphur, camola oil and cyelo-
pentadiene. Their findings show
how polysulphide groups on the
polymer surface react in the pres-
ence of pyridine catalyst at room
temperature to undergo S–S me-
thesis that joins together polymer
groups into a new shape. The new
rubber could, they say, be used to
make products including car tires,
which can be fully repaired and re-
stored to original strength in min-
utes at room temperature.

JUDGING REMARKS:
• Interesting approach, though the
commercialisation path is unclear
• Even many minor achievements
can add up to a significant advance
in sustainability

9  MITSUBISHI
CHEMICAL - MCPP /  
Incorporating renewable
carbon in a range of
applications
Mitsubishi Chemical’s TPE com-
pounds utilise ‘renewable’ carbon
derived from PCR/PIR streams, bi-
omass or carbon capture. They are
said to overcome barriers to using
bio-based or recycle materials in
TPEs for applications requiring high
levels of technical performance,
regulatory compliance and quality-con-
sistency. Formulations can include
40% of bio-based carbon, or up to
70% of recycle, for a wide hard-
ness range – both options available
in natural colour. Early applications
include over-moulded grips, sanitary
parts and industrial seals, with MCPP
also expecting commercialisation in
the automotive industry, especially
of bio-based solutions for interior parts.

JUDGING REMARKS:
• The potential is indeed high if the
material can outsmart PVC

10 Kraton Corp. /  
IMSS technology
Kraton has put in some serious
work in developing a challenger to
slush-moulded PVC in automotive
instrument panel skin applications.
As well as matching the fine-gauge
processability and physical properties
of the established polymer, the new
HSBC also offers benefits in terms of
lower part weight, reprocessability,
non-fogging and lower energy-con-
sumption during transformation. Ex-
citement mounts as the first (of se-
veral) commercial car model with the
Kraton IMSS technology is scheduled
to start production in Q4 2020.

JUDGING REMARKS:
• The potential is indeed high if the
material can outsmart PVC

Further details of all the Top 10 projects will be published on the ERJ website.

SUSTAINABILITY

CAN YOUR PROJECT
CHART HIGHER?
As the E4S rankings will be updated on a reg-
ular basis, companies and individuals are invited
to enter for review new pro-
jects throughout the year.
The next Top 10 is sched-
uled to be published in the
Nov/Dec issue of European
Rubber Journal magazine.
Please visit the ERJ web-
site for details of how to
enter your company’s pro-
ject for review.