

# Essenscia Innovation Award 2022

## Chemical symbiosis around green tires: every single lifecycle stage drastically improved

- Evonik invented a new generation of binders for green tires, also suitable for electric vehicles: excellent wet grip, up to 13% lower consumption, longer life, less fine dust and better recyclability.
- Proviron and Evonik jointly developed the process to produce these binders: effective, efficient, without emissions to the environment and using solar generated steam.
- The Evonik-Provion symbiosis combines best of both worlds: develop products and processes swiftly, create capacity for new additives in a very flexible way and market the products broadly.

# Abstract

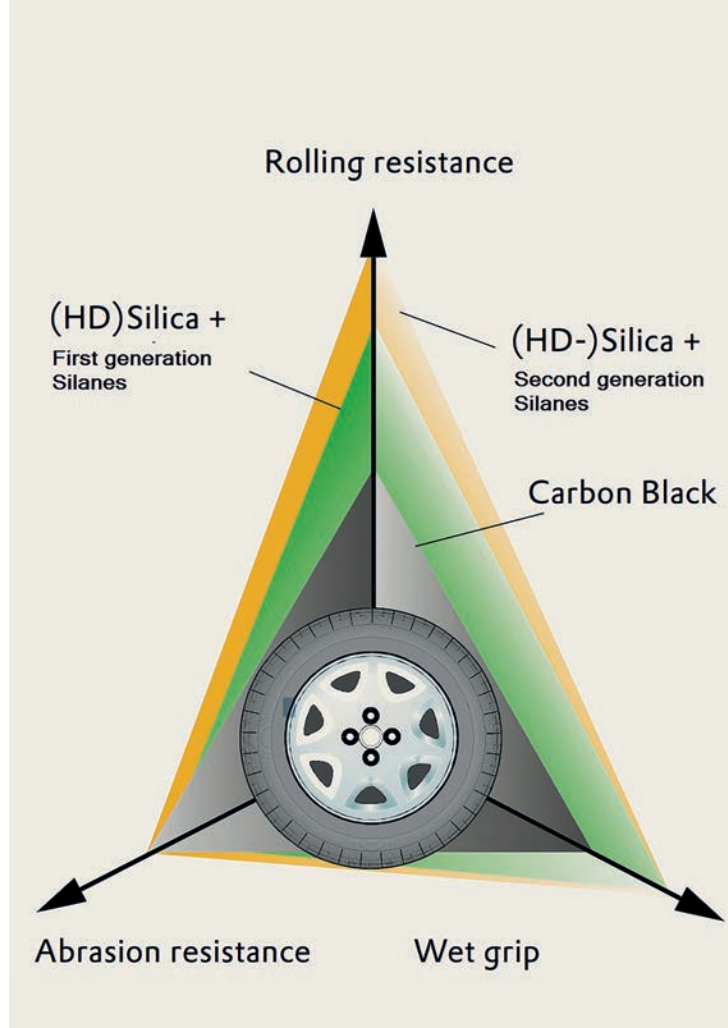
## Chemical symbiosis around green tires

New generation of binders for green tires to reduce fuel consumption and improve range of electric vehicles.

Evonik is a global chemical group that is, among other things, the market leader in tire additives and the only tire additive producer that is present in all global regions.

Proviron is a Belgian medium sized enterprise that focuses on sustainable products and processes.

Evonik invented a new generation of binders for green tires so that they are now also suitable for electric vehicles. First of all providing an excellent wet grip, which can be life-saving. In addition, these new green tires ensure 8 to 13% less consumption (compared to carbon black tires, due to low rolling resistance), longer life (due to high abrasion resistance), less fine dust and lower end-of-life treatment impact. This invention was patented.



Proviron's current binder plant in Ostend



Proviron and Evonik developed, in partnership, the environmental industrial process. The process is effective, efficient and water based instead of solvent based. Moreover, a large part of the required heat is provided by a solar boiler, making the production more CO<sub>2</sub>-neutral. The process technology and the many tips and tricks are deliberately kept secret.

Today, Proviron is building a factory in Ostend for Evonik in order to supply these pioneering molecules directly to the major tire brands all over Europe and beyond. When the volumes become really large, Evonik will produce these in Antwerp, as it does now for the current generation of binders.

Together, Evonik and Proviron thus ensure the lowest possible environmental impact from the creation of the green tire, throughout its useful life until its end-of-life far into the future.





# Unique innovation

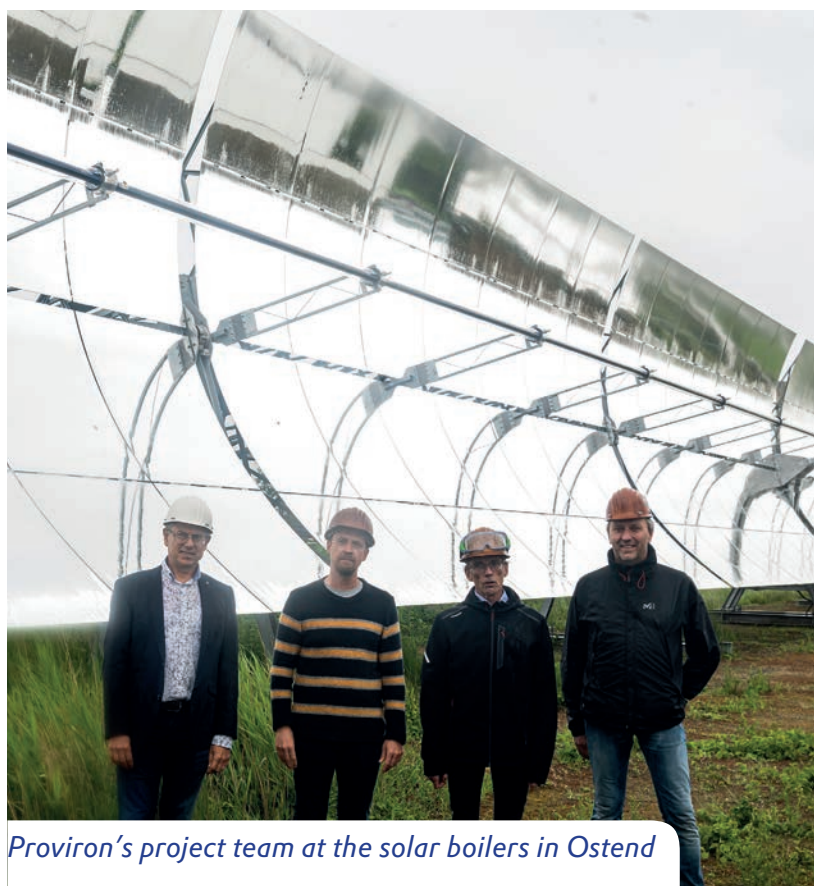
Evonik and its business line Silanes are already many years a producer of tire additives and have always played an important role in development of new tire additives improving rolling resistance, abrasion resistance and wet traction and braking. The first Silica/Silane tires reduced fuel consumption up 5-8 %, these reductions resulted in a global warming potential (GWP) reduction of 1.423 kg CO<sub>2</sub> per 150.000 km driven (cradle to cradle) compared to carbon black tires. In 2015 in Belgium we drove 84.300 million km. The savings of the Silica/Silane tires of the first generation therefore already contributed in an annual ~800.000 tons CO<sub>2</sub> reduction in Belgium alone. These tires have become common use and have almost completely replaced the pure carbon black tires.

Mobility is changing very rapidly and there is a need for new second generation silanes to further improve the tires and adapt the tires to the new E-mobility. The new generation of Silanes result in an even further reduction of 3-5% of fuel consumption which will lead to another ca. 900 kg CO<sub>2</sub> reduction per 150.000 km driven (cradle to cradle). This will further decrease CO<sub>2</sub> with more than ~500.000 tons of CO<sub>2</sub> in Belgium alone due to lower fuel consumption. Otherwise expressed, it increases the Worldwide Harmonized Light Vehicle Test Procedure range of electric vehicles by 3-5%.

These newly developed tire additives that will be produced in cooperation with Proviron are the first in a row that make tires meet these challenging targets set.

Not only the improved quality and fuel/energy savings are an improvement for the tires, these new generation of sulphur silanes are also produced throughout a new production process. This production process is water based and not VOC based. Therefore the production process emits no VOC's during the production in Ostend of these additives. By introducing a final polishing step on the waste water stream, even the slightest trace of unintended chemicals is removed from the effluents.

By combining various tips and tricks, the process for these pioneering products has been designed as efficiently as possible. This is what Proviron stands for during 45 years: using more efficient processes to ensure the least possible impact on the environment. The process has been demonstrated at lab scale and pilot scale. In order to reduce the CO<sub>2</sub> impact of production even further, Azteq's solar boilers will be used. Azteq places parabolic mirrors with a patented glass tube in the focal point, which also works efficiently in our area.



*Proviron's project team at the solar boilers in Ostend*



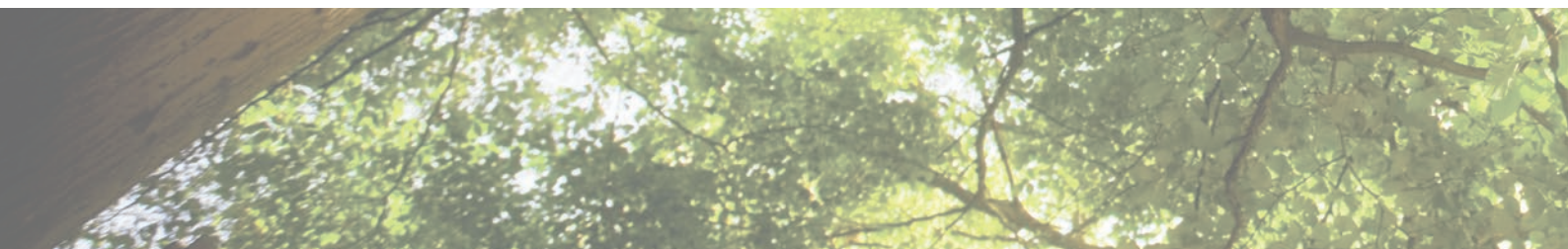
*Evonik's project team at the Proviron lab in Hemiksem*

## Sustainable development

The contribution to sustainable development cannot be underestimated. After all, it has an effect on the entire life cycle of a tire.

- During the creation of the molecules raw materials, water and energy are used as sparingly as possible. Every possible measure will be implemented to retain the last bit of residues and part of the energy comes from solar boilers.
- Improved and simplified process for the productions of the tires itself.
- From the first kilometer of use onwards, the tire reduces consumption up to 13.4% through lower rolling resistance compared to carbon-black tires. During development, particular attention was paid to the higher weight and torque of electric vehicles. By providing an excellent wet grip, the green tires can not only save lives it also reduces the amount of undesired repairs, lowering the impact on the planet indirectly too. These green tires are also much more wear-resistant thanks to a higher abrasion resistance. This means that they last longer, but more importantly, they reduce the emission of fine dust considerably.
- And after this long life, the end-of-life disposal impact is reduced by 40% compared to classic carbon-black based tires.

In addition, this is also a fine sustainable symbiosis between a global player and a large SME. These partners have already been working together for many years and have agreed to continue doing so. Together they ensure sustainable employment with a lot of added value in both Ostend and Antwerp.



# Intellectual property

Evonik has a very keen considered Intellectual Property (IP) Strategy. In this case, all different aspects of the tire additives are protected: production methods, purification methods and the additives itself.

Therefore Evonik filed different world-wide patents for the newly developed additives and also the different production and purification steps.

All inventions regarding the development and production steps are started from the research and development department of the business line Silanes located in Rheinfelden. Evonik has a Specialty Silanes plant in Rheinfelden that has Reactors ranging from 400l to 4.000l that are modularly build-up so that new products and production processes developed in the laboratory can be upscaled in house.

The development of the product was a joint achievement between the R&D of Evonik at Rheinfelden and the Specialty Silanes plant in Rheinfelden. This plant was at that moment led by an Evonik Antwerp employee that is currently also heading and upscaling the Silanes plants in Antwerp.

The development of the process was a joint achievement between Proviron's and Evonik's research and process development teams. The many tips and tricks of the process are deliberately kept secret. After all, it is virtually impossible to trace infringements of any production process, let alone enforce the rights in any country in the world. Moreover, some of these tricks can be used in the processes of other products in plants of the group.





STRENGTH DURABILITY BONDING ADHESION SOLIDITY HYDROPHOBIC

## Added value

The partners have already invested in research and development by combining the teams of Antwerp, Wesseling, Rheinfelden, Hemiksem and Ostend. Currently, a new factory is being built in Ostend amounting to a low double-digit M€ investment.

For Proviron, a 100% Belgian company, this production is its largest contract for toll manufacturing ensuring “the chemistry between us”. All added value is made in Belgium. Apart from R&D, quite some Belgian overhead is allocated to manage an impeccable delivery of these products. About 25 people will be directly employed in this state-of-the-art plant.

For Evonik, it is another pioneering step to be and remain a world leader in raw materials for tires. With this breakthrough green tire product range, Evonik is again “leading beyond chemistry”. The added value of the current product range is broadly and proudly made in Antwerp.

The R&D teams of Proviron and Evonik are supported through direct income tax excise, one of the main reasons why this R&D is performed in Belgium.

Evonik is currently also working on tire additives for truck tires. Truck tires are made of natural rubber compared to automotive tires which are produced with synthetic rubber. This also sets challenging goals for additives due to the fact that natural rubber is never the same. The cooperation between Evonik and Proviron enables shifting production capacities throughout the different production units swiftly.



# About Evonik Antwerp

Evonik Antwerpen nv is a part of Evonik. Evonik is a world leading specialty chemical company headquartered in Germany. Its over 33.000 employees generate an annual turnover of 14.000 M€. Evonik Antwerp is the largest non-German site with more than 1050 Employees and a turnover of 1.200 M€. At Evonik Antwerp there are several production units which produce different key products of Evonik's portfolio. The Business Line Silanes that cooperates with Proviron has also a world scale tire additive plant located in Antwerp.

# About Proviron

Proviron Holding nv is an industrial company, operating in Belgium through its subsidiaries in Hemiksem and Ostend. Proviron is a 100% Belgium medium sized enterprise, owned by its active Belgian management and a long time essencia member. Its 250 employees generate an annual turnover of roughly 80 M€. The small operation in West-Virginia, USA and the sales office in Hangzhou, Zhejiang, China ensure the company's growth is oriented towards export. The green tire binder production for Evonik is its largest tolling operation.





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