1. Please tell us the story behind Recykl and SMAPOL ?

Polish company Recykl Organizacja Odzysku S.A. (short Recykl) is the largest tyre recycler in Central Europe and the second largest in Europe. Company processes around 140.000 tons of ELTs per annum, which contribute to 5% of ELTs recycled in Europe.

Early in 2016 company has decided to innovate in all areas of its activity. The ultimate goal was to find higher margins on new products and to lower production costs. This was accompanied by a significant change in the perception of tires. For the first time, tires were seen as a source of valuable raw materials, rather than waste requiring incineration in cement plants.

The innovation process has started in all areas including textile processing, devulcanization, steel and crumb rubber cleaning, production process control etc., resulting in first patent application in 2016 for the textile based additive dedicated for road construction with the brand name SMAPOL. The first patent was granted consequently in 2019. The company continued the research and development process, which resulted in further patent applications, of which the company currently holds ten.

After four years of development company has built the first production plant of SMAPOL in Chełm. The production of SMAPOL has started in 2021.

2. Can you describe how the product is made using textile from discarded tyres?

The textile cord is recovered from selected discarded tyres in the mechanical tyre recycling (MTR) process. On each step of granulation and sieving the textile cord is separated using pneumatic aspiration systems and then collected. Further process steps include textile cord classification, cleaning and control of rubber properties and content, followed by surface improvement using chemicals and surfactants. The component composition and physical characteristics of SMAPOL granules are selected in such a way to ensure their long-term storage in the package, as well to ensure easy dosing into the asphalt mixer by any of the known methods, effective mixing and homogenization of SMAPOL during the production of asphalt mixes.

3. What led you to choose tyre textile for this product? Was it clear from the beginning to work with this material?

Indeed, thanks to our experience in various fields of science and technology, it was clear from the very beginning that tyre textile will be a perfect material for such application, nevertheless it’s processing, that we prefer calling conversion, was not evident nor simple. Number of mechanical, physical, chemical and application specific problems were to be addressed and solved.

From the very beginning we presented an interdisciplinary approach, inviting to our team engineers with multidisciplinary experience. Experts from tyre & rubber industry, road construction professionals, mixing plant operators, asphalt producers, machine builders, assisted our development work.

4. How did you discover the material?

Laboratory research first confirmed applicability of the material for roads construction. It has opened immediately a number of technological issues to be addressed under regular research and development programs.

So, we can confidently say that the fast prototyping approach allowed us to discover the material.

5. How is the material to work with?

SMAPOL was designed and optimized in a way to be applied to asphalt mixes using standard equipment existing already on mixing plants. It refers to pneumatic dosing systems for additives in granulated form. Packing is also standardized and includes 500kg so called half big-bags and small thermoplastic bags.

6. What specific properties of the tyre textile make it suitable for use in road construction

The tyre textiles are in fact a high quality and high tensile strength polymeric fibres designed to reinforce tyres and to grant tyres safety on the road. Tyre fibres are characterized by good adhesion to rubber, plastic and bitumens, good heat ageing and chemical resistance, high modulus, low thermal shrinkage, good dimensional stability – all we need in asphalt and roads applications. Tyre fibres are mixture of polyesters, polypropylene, rayon, nylon and aramid. Their mechanical resistance is much stronger that the asphalt binder matrix, so they are perfectly suitable for application as a three dimensional reinforcement of the so called asphalt mixes micro- and mezostructure. According to right scientific classification, our fibres create the microstructural reinforcement of the asphalt pavements.

7. How have you ensured that the textile material meets the necessary requirements and standards for road construction?

This is done by close cooperation with road construction companies, laboratories and national normalization bodies. Hopefully, the rules of designing properties of road asphalt pavements are similar not only across European countries but also across continents. Our main role, as well as the role of our distributors is to closely cooperate with customers at the stage of design of their respective recipes for asphalt mixes, which is done anyway by any supplier of road construction materials. This is the reason we run our own laboratory to develop and cross-check recipes dedicated for our customers.

8. Can you describe the process used to convert tyre textile into a finished road product?

As we said already, the process include textile cord classification, cleaning and control of rubber content, followed by surface improvement using chemicals and surfactants. SMAPOL is than granulated to satisfy stringent requirements of packing systems, storage, transportation and pneumatic dosing at mixing plants.

According to legal requirements in most of the countries, SMAPOL is a professional road construction product, and requires formal acceptance of dedicated national bodies issuing National Technical Assessments as well as the continuous production quality control, which in our case is assured and validated by SGS. National Technical Assessments are harmonized across Europe which simplifies introduction of the product on the territory of EU. The quality control is key for this category of products, since every big-bag and kilogram of the product should perform equally well in the asphalt mix, bringing the same properties for each square meter of the road pavements.

9. What benefits have you observed in terms of performance and durability of this product compared to traditional materials?

SMAPOL plays a role of a stabilizer of SMA and other gap-graded asphalt mixes, preventing delamination, segregation and binder drainage. In this context SMAPOL substitutes traditionally used cellulose fibers and is a lethal competitor for cellulose because SMAPOL is cheaper and brings numerous added values to road construction.

The asphalt pavement improved by SMAPOL differs by increased structural strength and uniformity, resistance to rutting, water/frost damage, and thermal and fatigue cracking.

Unlike cellulose, SMAPOL does not absorb bitumen, so the optimum content of asphalt in the road construction could be reduced together with construction costs. SMAPOL does not absorb water and consequently could be stored almost indefinitely even in uncovered places.

The paramount feature of SMAPOL, especially for future applications, relates with absolutely minimal CO2 footprint, extended durability, service life and full recyclability of asphalt pavements containing SMAPOL.

10. How much of the product consist of tyre textile?

Tyre textile is used entirely in the process, so we could state that 100% of tyre textile find its way in circular application in road construction. Besides the textile, SMAPOL contains certain carefully regulated and mandatory level of partially devulcanized fine rubber powder oscillating between 5% and 50% by weight.

11. What has been the feedback from customers and users who have tested the product in road construction?

We have encountered many different reactions from our customers. So called innovators grasp the idea very quickly and apply SMAPOL in all their projects exacerbating the fact that road construction become cheaper and less risky, as thanks to SMAPOL they have at their disposal an excess of good mechanical properties, fair above contract specifications. Some, value very much the ability to use SMAPOL in the asphalt mixes with RAP (Recycled Asphalt Pavements), where application of SMAPOL gives opportunity to reuse the highest content of RAP in the construction of new durable asphalt pavements. Some, are satisfied with economies due to the reduction of asphalt binder consumption. Some, are benefiting from application of cheaper ordinary road bitumen instead of using expensive polymer modified binders.

12. Are there any specific challenges or considerations when using tyre textile in road building?

Taking the first steps is always fraught with uncertainty, so it is good practice to profit from the help of our experts and the research results obtained so far. There are no technical barriers or specific, challenging processing conditions. The product was developed in a way to be easily applicable to the asphalt mixes with use of standard equipment accompanying each mixing plant.

13. Any recommendations for those who consider using the material?

Be brave and make foundations for the future of your business. All forthcoming tendencies related with ESG reporting, product passports, CO2 footprint reduction, circularity requirements will privilege the application of SMAPOL in the near future.

14. What future opportunities or developments do you see for the use of recycled tyre textile in the road sector?

There are many. Works accomplished so far with our customers demonstrate clearly numerous applications in all types of asphalt mixes for all categories of roads. We should expect new versions of SMAPOL dedicated to specific applications like AC or PA mixes, hot, warm and cold mixes, asphalt mixes with RAP and various rejuvenators available across the world. Versions with considerable content of rCB were already developed and patented, creating one another way to commercialize the product of tyre pyrolysis in industrial scale.

15. Any further comments regarding the material and its possibilities?

For the first time on the tyre recycling arena the waste textile material had been converted into valuable product dedicated to road construction. As a fully recycled and circular material, SMAPOL lays foundations to future generation of carbon credits.

Specific conditions of the production process and additives allowed us to produce a dedicated version of the product, which is used in the production of solid tyres as a filler for rubber compounds. This is another way of achieving circularity of tyre textiles. The product can be also used as a filler for all large-volume rubber products, e.g. marine fenders.