Sustainability in the PU industry

Industry leaders explain their perspective and strategy. (Part I)

During the last two decades, sustainability has gained immense importance for the whole chemical industry and, of course, also for the polyurethane industry. Aspects of sustainability are discussed along the whole value chain starting from raw materials and manufacturing over application to end-of-life. PU magazine had the chance to interview leading managers from the PU industry to learn about their understanding of sustainability and the efforts of the industry to improve the sustainability of our products and to enable a transformation from a linear to a circular economy.

Gesa Behnken, Global Marketing Director Insulation, Evonik

Maurizio Corti, Corporate Technology and R&D Director, Cannon

The time is ripe for sustainability

Within the last years, the discussions about sustainability increased dramatically, but the predominant feeling was that there was only little willingness to implement sustainable solutions. According to **Stefan Quaiser**, this attitude seems to belong to the past. "*The market is at full pace to evaluate solutions to enable the transformation. Whether it is legislation, consumer sentiment, or strategic positioning, many companies are realizing more and more that future competitiveness will be also based on the level of sustainability of their products and services.*"

Torsten Heinemann, Head of Innovation and Sustainability, Covestro

Marcel Moeller, Global Sustainability Director Dow Polyurethanes, Dow

This observation is proven by **Torsten Heinemann**: "*From Covestro's perspective, the intensity of implementing our sustainability strategy is speeding up.... The impression that things are slowing down can be attributed to the fact that we are facing a major industrial transformation. In the chemical industry, as we are discussing large-scale implementations, it takes several years for these changes to become visible and effective.... I see now that many things are moving in the same direction, partly due to regulations. This accelerates the process.*"

"*In terms of the overall market*", **Erik Vangronsveld** thinks, "*everyone is ready and willing.*" Nevertheless, "*the overall pace and degree of transformation has perhaps been at a lower level these past few years, but in certain markets the pace has not slowed downand key players have continued to work towards the development of more sustainable solutions*", he continues.

Stefan Quaiser, Head of the Polyurethane Business in Europe, Middle East, and Africa, BASF

Erik Vangronsveld, Global Materials and Industry Sustainability Director, Huntsman

Gesa Behnken also believes, that "*the competence level on how to make more sustainable products and how to quantify the sustainability improvements has significantly progressed in the industry in the last 10 years. Many companies now follow a more structured approach to improvement options for their portfolio based on CO_2 abatement costs, on the one hand, and a detailed analysis of market segments with already high interest in more sustainable offerings on the other hand.*"

Interview conducted by:
Wolfgang Friederichs
Editor-in-Chief

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Maurizio Corti is convinced, that "*technically, today, it is possible and likely simple to recycle and reuse polyurethane as industrial waste or at the end of life by chemolysis or mechanical recycling.*" But he also points out, that "*the market needs additional incentives or, better, obligations for recycling and reuse.*"

The evidence for the already existing technology is demonstrated by Dow and its partners. "*With regards to the recycling of polyurethanes, Dow and its partner company Orrion Chemicals Orgaform operate the world's first recycling facility at an industrial scale for end-of-life mattresses in France. In my view, this reflects a very tangible investment and pioneer mindset*", so **Marcel Moeller**. "*Particularly in Europe, recycled content in materials, recycling of end-of-life products, and other sustainability factors will be mandatory in just a few years for key polyurethanes markets.*"

How to improve the image of plastics?

Despite this positive news, plastics commonly still are demonized in the public and an often-heard misjudgment is that polyurethanes are not recyclable. Besides technical solutions, the industry also has to find ways to clear up misunderstandings and to give plastics (and polyurethanes) a positive image.

"*Industry has demonstrated that large-volume applications, such as flexible foam, can be chemically recycled. We have achieved recovery rates of up to 100 %, and we are actively working on scaling these technologies.*" According to **Torsten Heinemann**, "*Talking about these developments and our successes helps to engage with the public – be it with media as stakeholder and thus with the general public or other stakeholder groups such as academia, partners, and students, to name a few.*"

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Evonik also calls for deeds instead of words. "*From an early state, it was important to us to challenge this misconception and prove the feasibility of chemical recycling of polyurethanes, including the isocyanate part with proprietary developments*", so **Gesa Behnke**.

Erik Vangronsveld tells the same story in his own words: "*I think it's a bit like in sports. The only way to respond is to play and show them evidence to the contrary. That's why we continue to work hard on developing technologies … that will help enable more recycling and ultimately full circularity.*"

Maurizio Corti sees a problem in the fact that "*the public does not know anything about this issue. For common people, polyurethane is just plastic. On the contrary, individuals involved with PU usage know the matter well and are today already conscious that recycling is possible but too costly.*" He believes, that "*convincement comes again from incentives and obligations.*"

Stefan Quaiser relies on the existing "*end-of-live solutions for polyurethanes and the technologies that are rolled out together with customers, enabling recycling of polyurethanes.*" He is convinced, that "*the more these technologies are employed, the better the end consumers will value not only the high performance of polyurethanes but also its sustainability aspects.*"

The impact of polyurethanes on sustainability just by their usage

An aspect that is frequently forgotten in all the discussions about recycling and circularity, is the versatility of polyurethanes to supply sustainable solutions.

"*Polyurethane technologies address global challenges, from population growth and sustainability, to energy consumption – just to name a few. And we continue to see a preferential cost/performance position for polyurethanes versus other materials across multiple industries*", so **Marcel Moeller**.

Torsten Heinemann adds that "*the entire industry has to continuously communicate the benefits of the material class. These include outstanding material properties like insulation and lightweight characteristics, its durability, and the unique variety of highly efficient processing technologies.*"

"*The key is continuing to communicate openly, clearly, and frequently about innovative polyurethane developments and the environmental benefits that this strand of chemistry can bring across a range of applications. Polyurethane chemistry is an enabler, e.g. in insulation, lightweighting of cars etc.*", agrees **Erik Vangronsveld**. "*This work needs to be undertaken by individual companies, but also at an industry level.*"

The latter statement is confirmed by **Gesa Behnken**: "*To illustrate the benefits of polyurethanes to sustainability, associations play a crucial role. For that reason, Evonik is engaged in relevant international and national associations.*"

But **Stefan Quaiser** makes the critical note, that though "*there is hardly any material group that is as energy saving during its lifetime as polyurethanes, it is also very clear, that for the complete polyurethane portfolio, tangible solutions for end-of-life are a necessity. It is this ability to generate circularity that the industry has to further demonstrate in all of its segments.*"

> **There is a new economy emerging within a traditional industry, and we should be exploring and prioritizing all possibilities to advance more sustainable innovation.**

Maurizio Corti agrees, that "*polyurethanes are not easily replaceable in its major applications flexible foam for car cushions; thermal insulation for refrigerators, water heaters, trucks, and buildings, and tech elastomers.*" But again, he raises a warning finger: "*As a matter of fact, the high thermal insulation properties contribute much more to energy saving than other more eco-waste-friendly alternatives. But no one brings such evidence to the public, and polyurethanes are utilized without clamor because of their intrinsic properties.*"

Does sustainability need a new chemistry for polyurethanes

Though the use of existing well-established chemistry would by far be the most economical way to achieve sustainability goals, the industry is not quite clear in answering the question, of whether we need a (completely) new chemistry.

For **Erik Vangronsveld**, this question touches "*upon the key strength of the chemical industry: innovation! Our sector is an innovation powerhouse and both options are possible solutions that are being worked on. Some of these will become readily available. Others may take significantly more time to be integrated.*"

Gesa Behnken emphasizes "*the strength of polyurethanes lies in their versatility in terms of building blocks that can be used and how a system can be rebalanced.*" She believes "*the PU industry is already on a promising journey to adjust the currently used building blocks and to consider alternative raw materials for the existing products. As additive supplier, Evonik is committed to supporting customers with tailor-made additive packages so that they can adjust their systems based on, for instance, recycled polyols to ensure the right performance level.*"

Maurizio Corti states, that "*biobased polyols have been known and used for years, and they are more and more used due to incentives. Still, such a base is not strictly necessary, as the standard polyurethanes from fossil origin can also be recycled well. The most effort shall be made in setting the polymer chains to be easier to break in predetermined situations, like temperature setting and chemical ambient. For this, it is necessary to introduce the 'passport' for their specific composition and structure to permit a stated decomposition at the end of life.*"

Stefan Quaiser also admits, that "*for very specific solutions, completely new chemistry or discrete building blocks might be a solution.*" But he is confident, that "*the main transformation will have to be based on the existing portfolio.*"

The answer of **Marcel Moeller** goes in the same direction. For him, it is clear, that "*incremental improvements are unlikely to help our industry achieve our ambitious sustainability targets collectively; instead, a paradigm shift is needed toward developing and enabling sustainable products that are lower-emission, circular, and safer. There is a new economy emerging within a traditional industry, and we should be exploring and prioritizing all possibilities to advance more sustainable innovation. Researchers should be actively encouraged to question the status quo. Naturally, quality expectations and price points must still be met.*"

Torsten Heinemann continues also with a nuanced answer: "*First, we must acknowledge that we need to manage the legacy of polyurethane, a material class that saw industrial scale-up for several applications starting in the 1960s. There is already a significant number of polyurethane products in the market that we need to take care of when they reach the end of their lifecycle. This is a major challenge that both we and the industry are currently tackling. Additionally, we are gradually*

introducing new building blocks, such as biobased and other non-fossil raw materials, into our production streams. It is part of our daily operations to seek and industrially scale up these alternatives. Regarding changes to the chemistry, this is indeed an area we are exploring."

Sustainability: The winners and losers

The recyclability of polymers differs tremendously depending on their structure. Most polyurethanes are thermoset which makes recycling even more difficult. Thus, sustainability confronts polyurethanes with threats and opportunities.

The fact that polyurethanes are thermosets is not the only challenge. The major challenge is the versatility of the material class, which leads to a large number of recipes already in the market and that might be needed to address future material needs of our customer industries.

According to **Torsten Heinemann**, "*The fact that polyurethanes are thermosets is not the only challenge. The major challenge is the versatility of the material class, which leads to a large number of recipes already in the market and that might be needed to address future material needs of our customer industries. This challenge can only be tackled with a broad set of technologies and an openness to different approaches.... By tailoring these technologies to the specific needs of polyurethane applications, what might initially seem like a disadvantage can be turned into an opportunity.*"

Stefan Quaiser also sees the need for "*very specific recycling technologies due to the broad chemistry of PU. From mechanical recycling, where BASF has launched a breakthrough technology this year, towards depolymerization and gasification, all technologies will be necessary to ensure circularity of polyurethanes.*"

On the one hand, so **Marcel Moeller**, "*the versatility and durability of polyurethanes have made them highly competitive in both industrial and consumer markets. Moreover, the ongoing sustainability transformation presents additional growth and differentiation opportunities.*" On the other hand, "*polyurethanes must be competitive regarding the environmental footprint. As an industry, we need to be proactive in sharing the sustainability benefits of polyurethane products backed by scientific evidence. This will allow our customers to accurately compare polyurethane products with emerging alternative materials and make data-driven decisions versus following perceptions alone.*"

> Also thermoplastics do not have an infinite life cycle. After some recycling, degradation is unavoidable, and a difficult molecular reconditioning is necessary.

Maurizio Corti doesn't see any "*winners or losers. Simply, technology will change as it does continuously in all applications accompanying industrial and economic evolution. The obligation to recycle and mainly to reuse will surely introduce huge changes in the application and production of polyurethanes. But again, some applications have no alternatives. Moreover, I underline that also thermoplastics do not have an infinite life cycle. After some recycling, degradation is unavoidable, and a difficult molecular reconditioning is necessary.*"

Gesa Behnken also asks to bear in mind, that "*the performance of thermoplastics typically suffers over recycling cycles and contaminants are often an issue. Therefore, thermosets are not necessarily disadvantaged. Especially when they are used in highly demanding applications with a long life cycle. It is key not only to innovate technically, but also to ensure that the whole supply chain including waste collection is headed in the right direction.*"

For **Erik Vangronsveld**, the question of being a winner or a loser is not a special matter of recycling: "*There are many factors involved in why certain products are selected. A product needs to provide a compelling value proposition on technical, economic, and user experience grounds. Now, in addition, sustainability requirements are becoming more important. … Materials that are not able to meet the overall set of requirements are at risk of substitution.*"

To work together and against each other: how to solve the conflict?

To win the competition against other polymers, the polyurethane industry has to pull together in a concerted approach, but besides this competition, there is also competition between the companies within the polyurethane industry which can better be won by individual approaches and differentiation. All players will have to find the right balance between these two concepts. Both opinions are found within the industry:

For **Maurizio Corti**, "*Competition is always the best stimulus for doing better, which means not only being more efficient but also being more refined. The leading raw material suppliers in Europe and the USA are already converging to find similar solutions or lobbying toward specific standards.*" Nevertheless, he sees a threat that has to be solved by the industry as a whole, and that is "*the competition from the Chinese polyurethanes industry. Chinese are currently out of the circle and are making truly solid dumping thanks to their products. Rules and obligations to get back and recycle what is produced will help to compete against their market penetration.*"

On the contrary, **Torsten Heinemann** advises to work together: "*The major challenge is to set up new value chains. This involves not only defining and scaling the right recycling technologies but also ensuring access to sorted waste in the relevant regions and getting new product streams approved in our customer industries. At Covestro, we are working with several industrial partners to establish these closed-loop value chains, aiming to make industrialized end-of-life recycling possible in the future. With the*

Global Impact Coalition, for example, we partner with various players from the chemical industry to work on cross-industrial solutions. This shows that we have to overcome old ways of thinking – only together, we can move the needle. If we put all our brains and excellence into making solutions more sustainable."

This view is supported by **Gesa Behnken**: "*Collaboration along the new circular value chain is essential to develop the solutions the world needs. Competition between different solutions is welcome and necessary to ensure that enough diverse concepts are evaluated. In the end, collaboration with customers and other important value chain partners is essential to bring these technologies to the market. Another important activity is the cooperation with associations to ensure that PU is generally well understood and positioned.*"

The conflict between working together or not cannot be argued away according to **Erik Vangronsveld**: "*To win the competition against other polymers, the polyurethane industry must pull together. However, there is, of course, also competition between polyurethane providers within the sector who want to be first to market and differentiate their offer.*" For him, the only solution is "*finding the right balance*".

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Marcel Moeller also sees a need for more cooperation: "*In the past decades, companies operated within linear value chains. Each chain interacted with adjacent ones – upstream and downstream – but rarely extended beyond those boundaries. However, this ecosystem is now becoming obsolete, as it fails to address the challenges we face today. Now, industry ecosystems are evolving to be more inclusive, fostering dialogues, interactions, and innovations across the entire circle. We must learn from one another, develop strategies along new dimensions, and drive industry transformations. It's why many companies are departing from their historical positions in the value chain. Customers may become competitors, and competitors can become customers or partners. Moreover, companies that were previously unknown are now forming collaborations or joint ventures. We are entering an exciting era of new industry ecosystem designs.*"

Current sustainability projects within the polyurethane industry

The purpose of the interviews with leading companies in the industry was to draw a picture of the impacts that sustainability has on future developments, markets, and business models. We would like to thank the interviewees again for their input and their spirit of openness.

But the "*sustainability story*" does not start in the future, but is already full in pace, to cite one of the interviewees again. In the next issue of PU magazine, we will present an overview featuring, what projects the main players in the industry already are working on.