

SPECIAL:

Recyclates

Podium Discussion at IFAT

“The Combination of Mechanical and Chemical Recycling Is Unbeatable”

“Future of the Circular Economy: Chemical Recycling as a Building Block” – this was the slogan of the round-table discussion held within IFAT at the invitation of the Association of the Chemical Industry (VCI). In the discussion round, **Kunststoffe** acted as moderator and examined the issue from different aspects with representatives from industry, science and business.



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IFAT, the trade fair for water, sewage, waste and raw materials management, which is held every two years at the Munich exhibition center in Germany, was well attended. The Waste and Secondary Raw Materials Forum focused on the topic of the circular economy and chemical recycling one morning. About 200 participants followed the VCI's round of discussions led by **Kunststoffe** (participants: see p. 27).

Kunststoffe: Mr. Gahn, what is the importance of chemical recycling for the chemical industry?

Dr. Christoph Gahn: We see it as the future. We want to become

climate neutral; that requires large amounts of renewable energy. The clear goal is that our society – at least in Europe – will have reached climate neutrality by 2050. Chemical recycling is subordinate to this climate goal. From our present viewpoint, that will start with easy-to-recycle plastics that cannot be mechanically recycled. From those, we make pyrolysis oil, and feed it back into the system. That is the first step ...

Kunststoffe: ... and what could be the next steps?

Gahn: The complexity of the refuse is always the decisive factor. For example, if I have a pure polyamide 6, it can be very easily

returned to the system. It becomes more complicated in the case of polyolefin mixed wastes – in that case we currently turn to pyrolysis. If it becomes even more complex, gasification is brought in. Last but not least: a residual portion of the refuse will always be incinerated. That is completely unavoidable. But it applies to all household wastes, not only plastics. Here, carbon capture will play an important role in the future. That is the basic model; I estimate that it will be established by 2050 and will be nothing special any more.

Kunststoffe: *I want to take a step back now. Mechanical recycling is currently the gold standard in recycling – and therefore your core business, Mr. Ephan. Chemical recycling makes sense for particular waste streams. What form does your cooperation with the chemical industry take?*

Jürgen Ephan: We have developed from pure waste collection into a raw materials supplier. Every industry is currently in a process of transformation. The chemical industry is our most important partner because we are often dealing with complicated input materials – we have close links here. I am only worried that Germany will not be an attractive market for us because of the political possibilities.

Kunststoffe: *Professor Stapf, before we enter into the politics, can you explain to us from a scientific standpoint which waste streams chemical recycling is suitable for?*

Prof. Dr. Dieter Stapf: Chemical recycling is generally suitable for all kinds of waste materials, since we do not require particular purities but complex mixtures in highly functionalized products. Of course, there's a lot that can be mechanically recycled – and the amount is rising, since design for recycling is only just taking off. Nevertheless, we are currently only at 40 percent recycled plastics. We will have to recycle our complex products differently if recycling is to make progress. If we want to become climate neutral, we will have to use chemical recycling to make all the other things recyclable that cannot be reclaimed at present.

Kunststoffe: *Ms. Dr. Schmidt, what do you think of chemical recycling from the packaging point of view?*

Dr. Isabell Schmidt: We have set ourselves the goal of completely eliminating fossil-based raw materials from plastic products by 2050. The circular economy helps us to achieve these goals. We are relying on design for recycling and the use of recycled material. We have the goal of using a million metric tons by 2025. To achieve this goal, we only need greater amounts of higher-quality grades from material recycling. We have very many applications outside food contact, where even more recycled materials can be incorporated. In the long term, however, we will need new technologies or chemical recycling in order to also source raw

“We must be open to technologies and see what brings us forward.”

Prof. Dr. Dieter Stapf, KIT

materials for food-contact packaging materials. Currently, we have serious availability problems – after all, the material has to come from somewhere.

Kunststoffe: *Mr. Bauske, what homework does the chemical industry still have to do?*

Dr. Bernhard Bauske: With plastics, we currently have to deal with very different types of base materials and compositions – that makes life very difficult for the recycler. The materials should be designed so that they can be properly recycled. There's still a lot of work to be done here. But this also affects product design. We often have materials that can only be recycled into inferior products. In addition, the industry can also support us with prevention. With reusable products that are durable and can be cleaned. Prevention should take priority. As the WWF, we published a study “Packaging Turnaround Now” last year. This shows the high potentials in prevention. Here, we can see a large area of work for legislators as well as for the plastics and packaging industries. Before we even start talking about chemical recycling.

Kunststoffe: *In your study, you also concede a certain potential to chemical recycling. But only when everything else has been exhausted ...*

Bauske: Yes, we have to look at the life cycle of chemical recycling. What processes are on offer? A new technology that requires large plants needs to be planned, financed and built. The plants may have to be used for decades if the investment is to be worthwhile. We therefore have to examine beforehand whether mixed wastes can also be mechanically recycled in case of doubt. Here, there are a range of questions to clear up, also for special applications such as plastic-based textiles or carpets.

Kunststoffe: *Now I will pick just one point from this answer: the life cycle assessment. Mr. Stapf, what does the assessment look like for chemical recycling?*

Stapf: There are only a few studies so far. You always have to look at the product's entire life cycle – from my point of view that should always be the basis of political decision making. If we look at the recycling possibilities, compared to incineration as an alternative, recycling always comes off far better. I see a huge advantage for the climate and the environment. There's nothing to choose between mechanical and chemical recycling, both are very similar as regards their life cycle assessments. But a combination of the two processes is unbeatable – that is the key to the whole thing. Ultimately, we need more studies and more transparency about how these methods work. We need pilot projects that show what the life cycle assessments are; we need scalable technologies.

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“Recyclate quotas without material availability is equivalent to a marketing ban.”

Dr. Isabell Schmidt, IK



From left: Bernhard Bauske (WWF), Christoph Gahn (BASF), Isabell Schmidt (IK), Dieter Stapf (IKT), Susanne Schröder (**Kunststoffe**) and Jürgen Ephan (Remondis). © VCI

Kunststoffe: *At this point I would like to press you again. You say that there's nothing to choose between chemical and mechanical recycling as regards the life cycle assessment. Many believe that chemical recycling comes off worse. Can't they do the math?*

Stapf: There are different chemical recycling processes. For example, we can depolymerize polyamide 6. We can even convert polyurethanes back to their monomers with solvents, if we think of mattresses for example. These products can also be thermochemically recycled by pyrolysis or gasification. I think that many consider that too energy intensive, since it contains the word "temperature." The crucial thing is to use technology that is as efficient as possible and also to convert much of the waste material that I put in back into raw material. Then the energy balance is good.

Kunststoffe: *Mr. Gahn, the chemical recycling processes are developed to different degrees. Why do you rely on pyrolysis in particular?*

Gahn: In the packaging industry, 80 percent of plastics consist of polyethylene and polypropylene. Significant amounts are then available that, to some extent, cannot be mechanically recycled. And this is where pyrolysis makes most sense. In principle, you can picture that we cook polyolefin polymers at 430 °C and subsequently decompose them into an oil, which we then purify. The cleaning is very laborious, but makes sense in terms of the overall ecological picture.

Kunststoffe: *Where do the limits of mechanical recycling lie, Mr. Ephan?*

Ephan: We don't compare mechanical with chemical recycling. We have never

"Avoiding disposable packaging should take priority."

Bernhard Bauske, WWF

held a discussion about mechanical versus chemical recycling. We say: what we don't incinerate is certainly more efficient to recycle chemically from the point of view of the energy balance. We should discuss this approach in the public sphere. We would be glad to develop the prescribed quotas upwards, but there is a lot of room to grow here. We don't see the limit of mechanical recycling in percentages, but make it dependent on the contents. What makes sense? Where must there be different material flows in the future?

Kunststoffe: *Ms. Schmidt, what do you think of the issue of quotas?*

Schmidt: We are mainly occupied by the EU Commission's goals regarding the recycle input quotas for plastic packaging. We are very skeptical about them. If our industry is obliged to use certain raw materials, the availability must be guaranteed. Otherwise it is equivalent to a marketing ban. We believe that there are much shrewder regulation methods than those recycle quotas. For example, we could talk about financial incentivization to reduce the fossil raw materials content as early as the plastics production stage – in a similar way to CO₂ pricing. That would be a more fundamental approach than if legislators feel they have to define a very specific quota for each product. Legislators will never find the right quota that is both ambitious and avoids the serious risk of market bans. I say it loud and clear: if the industry is not confident that recyclates will be available, who will then invest in plastic packaging? That is the wrong signal.

"We have nothing against discussing ambitious goals."

Dr. Christoph Gahn, BASF

Kunststoffe: *Mr. Bauske, how do you assess the recycle quotas?*

Bauske: We must make use of various instruments – simple quotas are not

enough here. At present, it is not financially attractive to use recycled material. The underlying conditions must be right, and the material must also be available. The question of food safety must also not be glossed over. For example, how can materials be collected separately, as with the PET cycle for bottles? We need a supply of high-quality materials. Action is also needed regarding the question of standardization; there's work to be done at every level.

Kunststoffe: Mr. Gahn, we are interested in your opinion about political regulation.

Gahn: It first has to be clear how a quota is defined. At EU level, regulatory decisions on questions of mass balance of recyclates are in the pipeline, but there are also open questions. The industry needs clarity for investment decisions. We can't track molecules from waste through all value chains, through to the end product. For this, I need a classification principle that is flexible but can also be audited. We don't want greenwashing and we must therefore make existing ISO standards binding. Then we would also have an instrument for classifying recycled content. If, based on these legally binding rules, quotas are specified, we will try to keep to them. Of course, this is a controversial area. But we have nothing against discussing ambitious goals.

Kunststoffe: You talk of EU-wide unity. We are not even on the same track throughout Germany yet. The Federal Republic is lagging behind Baden-Württemberg, for example. Mr. Ephan, you also want an international mindset. How will we reach an agreement here?

Ephan: In our view, the EU Commission is doing this very properly, we are coming together internationally. Only Germany has a packaging law. In many parts of the world, for example the Netherlands or Denmark, chemical recycling is a recognized method. And in Germany we have been discussing its equal status with mechanical recycling for decades. We don't want to hold this discussion at all. Politics has simply failed us. We won't get involved at all here – and then implement these issues abroad.

Kunststoffe: Prof. Stapf, politics has failed. What do you consider a good way?

Stapf: As a scientist and researcher, I would say think and act according to the laws of nature. And implement what has the best life cycle assessment. Control quotas – that is a good start. It is bad if you determine that the quotas can only be reached by mechanical recycling. We shouldn't prescribe specific methods. We must be open to technologies and see what takes us forward.

Schmidt: Openness to technology is an important concern here. In the instant that we require a recyclate quota for food packaging, we abandon this openness. We could otherwise introduce these wastes into other applications via mechanical recycling. The quota forces us adopt chemical recycling so that

they meet the food-contact standards, without a guarantee that everything will succeed as planned. At the moment we are already seeing a recourse to other materials on the market. There are growth rates of six percent for paper laminates. To some extent with brown-colored paper that is plastic coated. That is not in the spirit of a circular economy.

Gahn: What problem are we trying to solve? We are trying to produce a genuine circular economy. Our ambition must be to recycle 100 percent of all substances by 2050. Then the regulatory authorities must specify quotas. What takes place within this framework remains open as far as the technology is concerned. We are therefore

greatly in favor of a regulatory framework that requires renewable energies and circularity.

Schmidt: But who gets the quota? Only the plastics processors – or also the plastics processing industry?

Gahn: The quota is open to everyone, market-economic laws come into play. The best possible solution will win. The solution comes from the combination of the methods. ■

Moderation: Susanne Schröder, editor

“The packaging law makes it difficult to discuss chemical recycling in a way open to different technologies.”

Jürgen Ephan, Remondis

On the Podium

Dr. Bernhard Bauske is project coordinator for marine litter at the WWF.

Jürgen Ephan is managing director of Remondis.

Dr. Christoph Gahn, as Vice President at BASF, is responsible for chemical recycling processes.

Dr. Isabell Schmidt is managing director at IK, the Industry Association for Plastic Packaging.

Prof. Dr. Dieter Stapf is head of the Institute of Technical Chemistry at the Karlsruhe Institute of Technology (KIT).

The participants held the discussion at the initiative and invitation of the VCI, Association of the Chemical Industry.

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