Adapted version from the German original. PLASTVERARBEITER March 2009

CHANCES OF PROCESS INTEGRATION USING PLASMA TECHNOLOGY

“COMPANIES HAVE TO OPEN UP”

Atmospheric plasma technology has significantly increased process integration in the injection molding industry. What are the next steps to be taken, and what does this mean for equipment production in Germany? This was discussed by Dr. Erwin Bürkle, executive new technologies from KrausMaffei Technologies, Klaus Hilmer, executive of the user pilot plant station TPU from Elastogran, and Christian Buske executive Plasmatreat, in the framework of a press talk.

Plastverarbeiter: **Dr. Bürkle, which trends within the plasma technology do you follow up? Which trends will lead to further development in the injection molding industry?**
Bürkle: Nowadays, energy and resource efficient production methods are being looked for with great emphasis. One wants to save costs and time and to reduce the scraps, which means to improve the quality of production. One key for that is the substitution of known production steps with more efficient and newer processes and to put all manufacturing operations into one single unit. The fewer production steps, the fewer sources of defects. Atmospheric plasma supports this trend very well, as materials can be pre-treated inline, within a production unit. Similarly, the procedure is suitable for continuous processes like extrusion as well

Plastverarbeiter: **Which are the latest innovations?**
Bürkle: One new development is a rotary-injection molding machine, which enables the combination of various processes into one step. In the first step the master forming takes place (e.g. textile reinforcement structures or come systems), then the tool opens up and turns 90° for the plasma
pretreatment for adhesion enhancement. After that the tool turns 90° again, to functionalize the part, e.g. by a second plastic component. In one process now the three processes of shaping, master forming and plasma treatment are integrated.
Hilmer: And there is another advantage: in the 270° position of the tool demolding can take place cycle- time- noncritically or inlays can be inserted. In summary the cycle time can be reduced. That’s perfect.
Bürkle: There is a huge potential that is not being exploited yet. Thinking of the automotive industry
only, where everything has to be easy and cost efficient. In this industry solutions are increasingly looked for and interestingly the OEMs do approach us mechanical engineers already for them.

Plastverarbeiter: **A first step to increase the efficiency of the part manufacturing, Mr. Hilmer?**
Hilmer: Yes, indeed an impetus can be made out and this tendency emerged already before the crisis. The OEMs do think about how they can achieve a higher added value, higher integrated
processes and higher functionalized parts. – And this in situ here in Germany and maybe even cheaper than at another site. The German OEMs want to influence the technical processes of their suppliers now. That’s new.

Plastverarbeiter: **In consequence - which further development do you expect for the production-site Germany? Will the production be partly relocated back?**
Buske: It seems like this is exactly the whole purpose of these endeavours. Within Europe every country has a different insolvency law. And if all of a sudden a company in Eastern Europe, which plays a key role in automobile manufacture, ceases to exist, certain models can no longer be built. Given the world-wide depression such aspects are re-evaluated. After all complex systems cannot be purchased somewhere else from one day to another.


Dr. Erwin Bürkle


Christian Buske


Klaus Hilmer

“The OEMs are thinking about how they can influence the technical processes of their suppliers. That’s new.”

Klaus Hilmer, Elastogran

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Bürkle: This is the chance for our site to survive in the long run. Standard machines can be built by others but complex, highly integrated systems are clearly our strength. This chaining of processes, the shortening of the added value chain, to produce economically more effective and qualitatively better, this could become our domain. And therefore, I believe, we should think and act even more in networks. At present this certainly is still a learning process.
Buske: We can only solve the challenges if we search for creative partners. It is important that the companies open up. Otherwise there will be no common result.

Plastverarbeiter: So networks are decisive. Inter alia there is the "Workshop Injection Moulding". How open are such activities for other companies?
Buske: These are open workshops. Who ever signs up, will be participating. It is common practice that huge fabricators who develop themselves are involved in the current processes and analysis in these networks. So companies learn from the problems of the other companies. Nowadays innovations can only be brought forward together with partners from the material and machine sector.
Bürkle: The competence networks are getting more and more important. The integration of processes makes manufacturing more complex. Partnerships are needed to find the right solutions very quickly. Our house also uses such networks extensively, e.g. with the topic light construction. In this field we are working together with Universities who perform the basic work. Simultaneously we involve the industrial concern to develop solutions for the practice. And if one has been working together for years, new ideas emerge from every talk. This creates a massive pool of possibilities to implement new technologies – brand-new perspectives open up.

"We can only solve the challenges if we look for creative partners. It is important that companies open up."
Christian Buske, Plasmatreat

"Standard machines can also be built by others, yet complex, highly intelligent systems are clearly the strength of machine builders in Western Europe."
Dr. Erwin Bürkle
KraussMaffei Technologies

Plastverarbeiter: What do your visions look like? How far will process integration go? What products and capabilities of the plasma technology are you thinking of long-term?

Bürkle: One can create more than adhesion with the plasma technology. One can also do completely different things e.g. in the field of surface technology. For example, a ski-jump ski can be made faster. A polymerisation of the surface could be integrated into the manufacturing process. All of a sudden completely new material properties are created, which so far might only imaginable by applying an additional layer. Of course, the surface of a mono system could also be partially treated with plasma technology. All in all this technology establishes a very high flexibility.
Buske: We are already working on projects, where we are changing the haptic of the surface by means of plasma polymerisation so it feels like leather. And the developments do not stop there. We can create barrier layers that keep additives within the plastics. This means, the materials are being made resistant to solar radiation, water and oil. For example in the form of sun tan lotion oil keeps leading to problems. Here we are talking about an extension of the durability of plastic products.
Hilmer: There are huge displacement claims on the market, e.g. in the field of extensive automobile seals. The sealing systems for engine hoods, trunk lids, doors and the glass panels are currently being reconsidered. Currently much of these items are manufactured from EPDM, a cross-linked rubber, which needs to be coated. It is very complex to bond an EPDM profile with a polyamide or POM-gusset shoe. . Here the thermoplastic options are considered, and where the direct injection of the seal facilitated by inline plasma treatment can take place to simplify assembling. That will be the result on the long run. I claim that 50 per cent of all rubber seals can be replaced by thermo plastical elastomers. Therefore plasma integration is necessary, which will later on pay off in weight and price.
Bürkle: Thinking of the medical technology: there are parts being extruded, wrapped and transported through the whole country for sterilization before the parts are being sent back to the manufacturer for assembly. If I take into consideration that one can also sterilize with plasma, I see a huge potential. If we succeed in performing the whole process from manufacture to the outer packaging GMP- compliantly, a lot of problems can be eliminated.

Susanne Zinckgraf

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The 2C adjustment knob consisting of a hard polypropylene (inside) and a soft TPU injection moulded shell, was manufactured by Müller Technik as a test piece. Photo: Plasmatreat

Plasma Technology

Strong in hard/soft bondings

Around 300 pairs of material have so far been tested under the framework of the industrial workshop “Assembly injection moulding/inline plasma treatment”. Hard/soft bonding material pairings are the focus of this work. Inter alia it could be shown that thermo plastic polyurethanes (TPU) can be bonded with polyamide, polypropethylene, polystyrol and PBT strongly and reliably with only plasma pre-treatment. An up to date example of such a product is a two-component-handwheel adjuster made by the company Müller Technik. It is made of polypropethylene with a moulded on TPU. This combination of materials could not be realized without plasma technology. So far a cost intensive ABS/PS formed the thermo plastic basis of the part. The characteristics of the part could be optimized by the plasma pre-treatment. The bonding is enduring oil exposure and ultraviolet radiation. Another example is a hybrid-part for the medical technology of the company Gira, which is on the verge of serial insertion. The part consists of stainless steel in combination with a TPU. After the cleaning of the steel by plasma which takes only a few seconds a very good bonding is achieved – without primer or sandblasting. Most applications of the atmospheric plasma technology thus far come from the automotive sector, aside systems have been sold as well into the electronic manufacturing and packaging industries. In the packaging sector the contractor of plasma systems Plasmatreat is expecting the greatest growth. Amongst the new fields of application with the potential to increase are composites and aerospace.

New Technologies

Key technology: atmospheric plasma

Strong cohesive bonds for multi-component injection moulding have conventionally only been possible when the plastics are compatible with each other or the materials have been modified by a previous step. Using atmospheric pressure plasma a pretreatment of the first component can be performed in the mould to activate the surface of the material. This high energy surface can then be used to bond strongly with materials that might not normally be compatible as well as improve bonding with compatible materials.Technology and resource suppliers, plastic fabricators and research institutes are working closely together to deploy the technology even more industrially. More than twenty companies have for example joined the industrial workshop “Assembly injection moulding/inline plasma treatment”, since it’s inception in 2004.

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Basics and appliances

Plastverarbeiter reported on the basics and various applications of the plasma technology in previous publications. The articles are standing by for download free of charge. Search for **0309PVPlasmatreat** on **www.plastverarbeiter.de**

CONTACT

Christian Buske and Leonhardt Enneking, Plasmatreat, Steinhagen, christian.buske@plasmatreat.de, leo.enneking@plasmatreat.de

Dr. Erwin Bürkle, KraussMaffei Technologies, München, erwin.buerkle@krausmaffei.com

Klaus Hilmer, Elastogran, Lemförde, klaus-l.hilmer@elastogran.de