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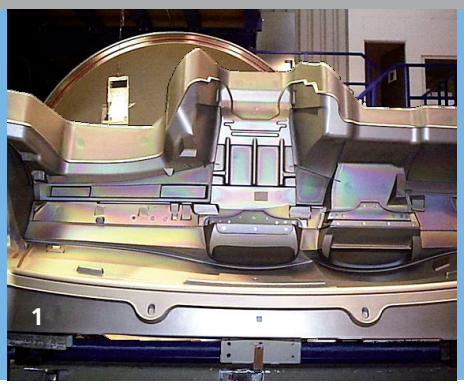
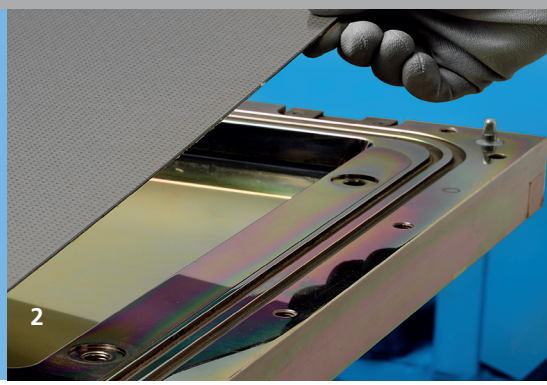




1 *Release$^{PLAS®}$ coated dashboard-tool for the release agent free manufacture of PUR spray skins.*

2 *RTM mold with Release$^{PLAS®}$ coating for manufacturing CFRP sheets.*

Fraunhofer Institute for Manufacturing Technology and Advanced Materials IFAM
– Adhesive Bonding Technology and Surfaces –
Wiener Strasse 12
28359 Bremen | Germany

Institute director
Prof. Dr. Bernd Mayer

Contact

Plasma Technology and Surfaces PLATO
Dr. Klaus Vissing
Phone +49 421 2246-428
klaus.vissing@ifam.fraunhofer.de

Dr. Matthias Ott
Phone +49 421 2246-495
matthias.ott@ifam.fraunhofer.de

www.ifam.fraunhofer.de

RELEASE$^{PLAS®}$ TECHNOLOGY

The manufacture of fiber reinforced plastic (FRP) components without using release agents would avoid costly processing steps and so is particularly attractive from an economic point of view. The development and optimization of Release$^{PLAS®}$ coating technology by the Plasma Technology and Surfaces PLATO group at Fraunhofer IFAM, working in collaboration with industry, has now made release-agent free FRP production a reality. Release$^{PLAS®}$ is a contour-mimicking coating having high adhesion to the substrate and high cohesive strength. It is applied directly onto the surface of the mold and remains there for a very long time. There is no transfer of coating to the component surface, as often observed with organofluorine coatings. The properties of the release coating can be adapted to particular plastic components. Furthermore, the coating precisely mimicks surface structures, allowing the manufacture of very smooth or nanostructured and microstructured component surfaces. The Release$^{PLAS®}$ coating is suitable for many reactive plastics such as polyurethane (PUR) and epoxide (EP). It can also be used in combination with in-mold coatings. By identifying suitable materials and curing reactions, it can be ensured that a high number of demoldings can be undertaken using this dry demolding process.

Advantages

Release$^{PLAS®}$ technology has already been successfully employed for manufacturing large carbon fiber reinforced plastic (CFRP) and glass fiber reinforced plastic (GFRP) components using resin transfer molding (RTM). Here the design of the mold and demolding step were already taken into consideration in the planning phase. The coating has also already been successfully employed in reaction injection molding (RIM), radiation-induced vacuum consolidation (RVC), and in open foaming processes.

- The demolded component can be immediately painted or activated e. g. for adhesive application because there is no transfer of adhesion-reducing substances to the component.

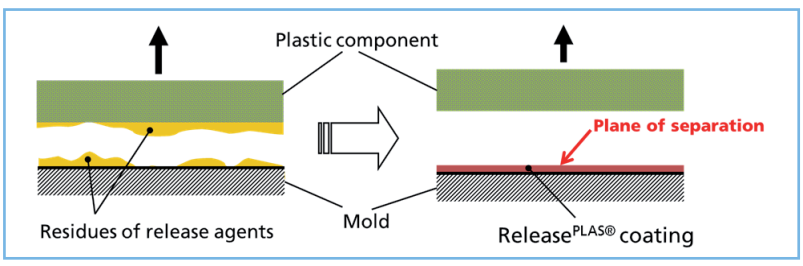
- Release[PLAS®] technology is of particular interest for use with rapidly curing resin systems. It enables the production process to be streamlined because no release agent has to be applied and the mold has no longer to be regularly cleaned of release agent residues.
- A cost and time effective production process requires not only efficient component release from the mold, but also requires consideration of dosing valves, ventilation systems, and in particular seals. These aspects are also being addressed by Fraunhofer IFAM.

Release agents and their drawbacks

Release agents are essential for manufacturing fiber composite components. Prior to the start of the layer build up, they are applied to the entire surface of molds in order to ensure subsequent easy removal of the cured components. On removing the fiber composite components from the mold, the separation occurs within the release agent layer. This is why some release agent always ends up on the component surface. These release agent residues must be removed prior to coating or bonding the fiber composite components. This can be achieved by cleaning or surface abrasion of polymer matrix, for example via grinding/sanding or grit blasting. It is also necessary to regularly remove release agent residues from the surfaces of the molds. This process is costly and time-consuming because the residues are not soluble. The higher the requirements on the quality of component surfaces, the more critical the cleaning issue becomes. Residues on molds impair surface gloss and surface structures (e. g. the grain of leather). They are also detrimental to the optical properties of component surfaces.

Solutions from Fraunhofer IFAM

For many years Fraunhofer IFAM in Bremen has been working on issues related to the use of release agents, including the removal and reaction of release agents on fiber composite components, in-line quality monitoring, and the replacement of release agents by permanent release layers. Another main area of work is investigating and monitoring interphase formation in reactive polymer systems which is the basis for adhesion and separation processes. Besides Release[PLAS®] technology, the Plasma Technology and Surfaces PLATO group at Fraunhofer IFAM has also developed a novel release film which is marketed under the name Peel[PLAS®]. This is of particular interest for manufacturing large FRP structures. One of the latest developments is Heat[PLAS®] release film which is suitable for high temperature applications up to 400 °C.



3 *Principle of demolding plastic components using conventional release agents (left) and Release[PLAS®] coatings (right).*