



**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

Automation and
Production Technology
Research Center CFK North, Stade
Dipl.-Ing. Gregor Graßl
Phone +49 4141 787 07-222
gregor.grassl@ifam.fraunhofer.de

Plasma Technology and Surfaces PLATO
Dr. Matthias Ott
Phone +49 421 2246-495
matthias.ott@ifam.fraunhofer.de

www.ifam.fraunhofer.de

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RELEASE AGENT FREE FRP COMPONENT MANUFACTURE USING FLEX^{PLAS}[®] RELEASE FILM

Flex^{PLAS}[®] release film

In order to be able to manufacture large fiber reinforced plastic (FRP) components – such as those used for aircraft and wind turbine construction – which are free of release agents, researchers of Plasma Technology and Surfaces PLATO and experts in the Automation and Production Technology at Fraunhofer IFAM have developed a deep-drawable Flex^{PLAS}[®] release film. This is an elastic polymer film with a flexible plasma-polymer release layer that allows easy removal of components from molds, even when stretched by 300 percent.

The film can be applied using a special deep-drawing process without alteration of the tool design, and is suitable for both female and male molds.

Benefits

The Flex^{PLAS}[®] release film has already been used to manufacture large carbon fiber reinforced plastic (CFRP) components on a 1:1 scale, without using release agents, via a **prepreg process** at 180 °C in an autoclave.

The innovative Flex^{PLAS}[®] release film is not only suitable for use with prepreg technology but can also be used for other manufacturing processes such as the **(vacuum) infusion process** or the **wet layup process**. The release properties of the flexible release film are not solely limited to carbon fiber and glass fiber matrix resins.

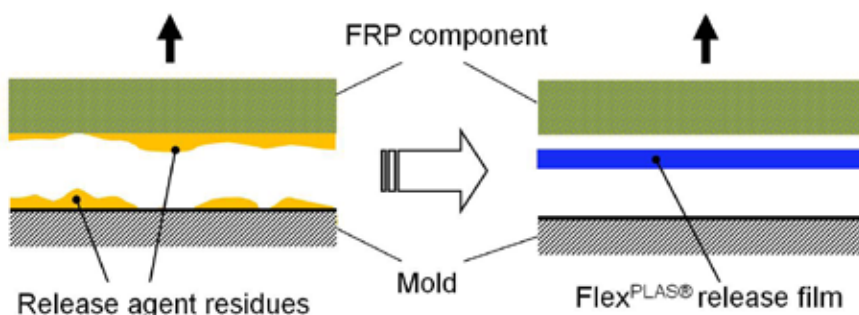
Large scale components can be **painted/lacquered** without any further pre-treatment because the use of the release film

allows a clean removal from the mold without transfer of any residues.

In addition, the new technology allows **in-mold coating** of fiber composite components, whereby the component is coated by applying a gel-coat to the film (Fig. 2). The matt effect of the coated surface can be adjusted via the roughness of the Flex^{PLAS}[®] release film that is employed. The risk of coating defects is significantly reduced using this approach.

Besides obviating the need to apply release agent on the surfaces of molds, the **productivity** of various other steps in the process chain can also be increased by using Flex^{PLAS}[®] release film. Notably, there is no downtime required to thoroughly cleaning the molds and free them from release agent residues. This means that the service life and availability are considerably increased. Fiber composite components can be coated without release agent residues having to first be removed.

Furthermore, if the film remains on the component to the end of the process or up to delivery to the final customer then it also acts as a **protective film**.



Problems of release agents

Release agents are essential for manufacturing fiber composite components. Prior to the start of the layer build up, they are applied to the full surface of the molds in order to ensure easy removal of the cured components. On removing a fiber composite component from a mold, the separation occurs within the release agent layer.

This is why some release agents always end 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 resin materials via grinding or blasting processes.

It is also necessary to regularly remove release agent residues from the surfaces of the molds.

Solutions by Fraunhofer IFAM

Fraunhofer IFAM in Bremen, Germany, has for many years been working on issues related to the use of release agents. These work areas include the removal and reaction of release agents on fiber composite components, in-line monitoring, and the replacement of release agents by permanent release layers.

The scientists of Plasma Technology and Surfaces PLATO have already developed an ultra-thin plasma-polymer release layer to replace release agents. This is already being used, for example, in the car manufacturing industry. A prerequisite for this technology is that the mold is coated in a low pressure plasma reactor. This is, however, not viable for the manufacture of large fiber composite structures for reasons of size. This shortcoming is solved by the newly developed Flex^{PLAS}[®] release film.

- 1 Ready-to-print surface after removal of Flex^{PLAS}[®] release film from a CFRP component.
- 2 Removal of the Flex^{PLAS}[®] release film from a FRP component that was in-mold coated with a gelcoat.
- 3 Flex^{PLAS}[®] release film after deep-drawing in a double-curved mold.
- 4 Principle of removal of FRP components from molds using conventional release agents (left) and the innovative Flex^{PLAS}[®] release film (right).