



- 1 *Manual application of a moisture-curing polyurethane adhesive from a cartridge.*
- 2 *Bonding glass in vehicle manufacture.*

## POLYURETHANE-BASED MATERIALS

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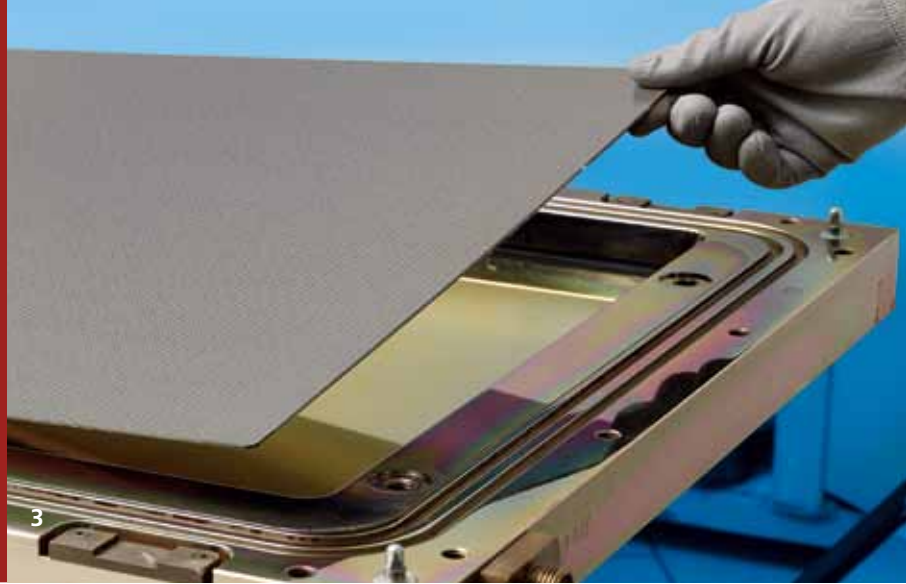
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### Polyurethanes in adhesive bonding technology

Modern industrial bonding technology would be unthinkable without polyurethanes (PU). PU are key base polymers for a host of different adhesives. Their properties cover the full range from thermoplastics to elastomers and thermosets. The wide range of raw materials enables systems as diverse as aqueous dispersion adhesives, reactive hotmelts, sealants, and high-strength structural adhesives to be formulated. This diversity has led to wide usage for a host of applications and high acceptance in many industries. The latter include the automotive, shoemaking, construction, furniture, and packaging sectors.

### Structure-property relationships

A key area of research at Fraunhofer IFAM is geared to advancing the understanding of polymer structure, morphology, and the resulting bonding properties in order to optimize the effectiveness and performance of polyurethane-based bonded joints. Careful selection of the raw materials enables not only network densities and any hard/soft segmentation to be created but also allows many of the original properties of the raw materials to be retained in the resulting PU joints. The interactions between the components are very complex. This means, for example, that for the same adhesive composition merely the nature of the catalyst used can change the chemical functionality of the PU and alter the resulting adhesion properties. In order to characterize PU materials and identify the mechanisms responsible for bonded joint failure, Fraunhofer IFAM has a wide range of analytical methods for characterizing polymers and surfaces.



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### **Production of surface-modified polyurethane components**

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Understanding the mechanisms of adhesion failure is also vital in other areas, for example for the demolding of polyurethane components produced by reaction injection molding (RIM). Here, adhesive fracture between the PU and mold surface is desired and is achieved by application of a permanent release layer to the surface of the mold. The ReleasePLAS® release layer system developed by Fraunhofer IFAM obviates the need for conventional internal and external release agents and avoids the associated drawbacks. In combination with surface-active additives that concentrate and are chemically bonded in the outer layer of the PU, the release properties of molded components can be improved even more.

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### **Range of services offered by Fraunhofer IFAM**

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The range of services offered in the area of PU materials and PU-based adhesives includes:

- Development of new formulations
- Development of guide formulations with your raw materials
- Development of novel polyols
- PUs based on renewable raw materials
- PU-based emulsion polymers
- Low emission PU (analysis of cleavage products and isocyanate emissions)
- Isocyanate-free synthesis of PUs
- Dynamic properties and aging of bonded joints