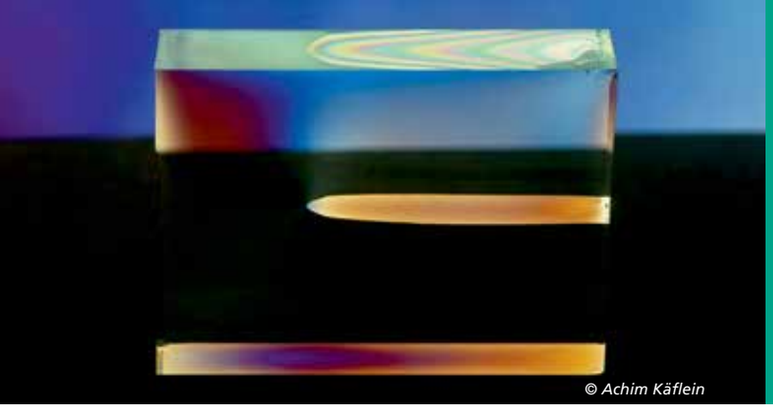

Thermally induced crack in a block of glass.

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Application examples

The Fraunhofer IWM has many years of experience in designing cutting processes for brittle materials. Various methods have been developed in our well-equipped laboratories for thermally cutting different types of glass and laminated safety glass. Particular emphasis has been given at each stage of development to the adaptation of the process to the specific material to be cut, in order to realize as much of the potential of the material as possible. At the same time, the demands of implementing such methods in an industrial environment have been taken into account to a high level, resulting in a series of functioning modules for production machinery.

We assist our customers by developing and implementing new techniques, we perform feasibility tests and develop the necessary know-how to ensure that they master the special cutting process to a sufficient degree.

Fraunhofer Institute for Mechanics of Materials IWM
Wöhlerstrasse 11
79108 Freiburg, Germany
Phone +49 761 5142-0

The Fraunhofer IWM is the point of contact for industry and public contracting bodies concerning component and systems reliability, safety, durability and functionality. The Fraunhofer IWM's "mechanics of materials" services focus on identifying weaknesses and defects in materials and components, determining their causes and building upon this to realize solutions – including material development, manufacturing processes and testing procedures – that lead to the efficient and reliable use of components.

Contact
Matthias Gremmelspacher
Phone +49 761 5142-225
matthias.gremmelspacher@iwm.fraunhofer.de

Dr. Rainer Kübler
Phone +49 761 5142-213
rainer.kuebler@iwm.fraunhofer.de

WWW.IWM.FRAUNHOFER.DE

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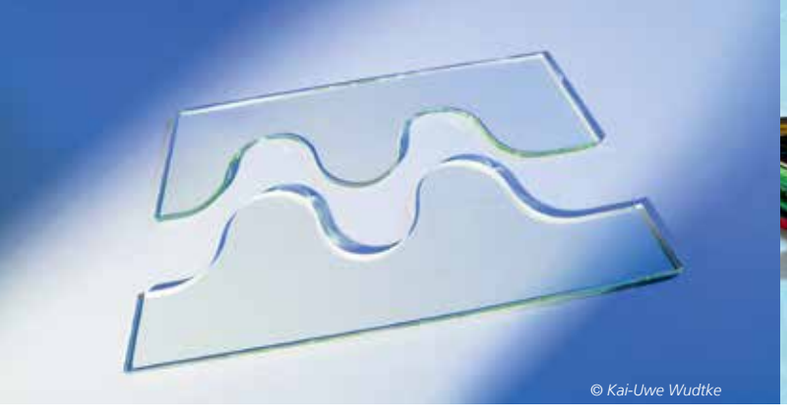
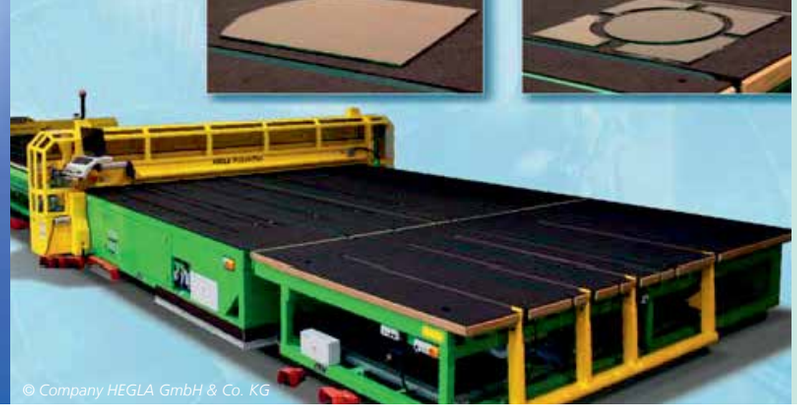
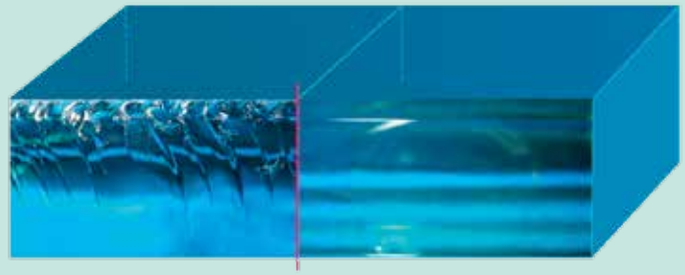
SEVERING OF GLASS, FLAT GLASS, LAMINATED SAFETY GLASS AND HOLLOW GLASS



Thermally cut contour.



Cutting unit for laminated safety glass (VSG) from our partner company HEGLA with templates.



Comparison of edge quality: glass panes cut using conventional method and with thermal cutting.

Thermal cutting of glass

In contrast to conventional cutting processes, in which micro-fissures form in the break edge, with this process glass can be cut with almost no defects. This is achieved by introducing deliberate thermal stresses into the glass. Local stress fields, which are used to guide a separating crack through the glass with contour precision, are typically generated using laser light. Lasers can apply heat controllably to exactly the right position and with exact timing, which makes them an ideal tool for this task.

Thermal cutting techniques are also possible using precision localized cooling or with a combination of heat and cooling. The main advantage of thermally cut glass edges is that far fewer faults occur at the edges and those that do occur are far smaller than the many micro-cracks that are caused by the scoring and break that occur in conventional cutting. The size of faults and their statistical distribution over the surface of the glass have a major influence over its strength under load. Thus glass components made with thermally cut glass can be used in applications that call for high levels of strength.

Cutting of VSG laminated safety glass

With our competences in materials mechanics in glass and plastics, in optical laser light guidance and in evaluating the mechanical properties of materials in manufacturing processes, we have devised a new method of cutting laminated safety glass. With this method the internal PVB polymer is first cut using the laser light and then the glass is cut. This allows new insights for the design of cut laminated safety glass.

Properties of laser-supported VSG cutting

- PVB polymer is cut by laser beam
- Cutting of the PVB polymer within the laminate is independent of the glass cutting process
- Process offers new possibilities for creating customer specific contours and also opens up the way to automated cutting of VSG models
- Process is integrated into a VSG cutting unit of the company HEGLA

Laboratory equipment and tools

- Various laser sources and wavelengths
- Mechanical testing methods (tension test, bending, double ring)
- Microscopic analysis processes (light microscopy, scanning electron microscopy)
- Simulation (finite elements, particle-based numerical methods)