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Corning Laser Technologies GmbH

Laser Cutting of 3D-Shaped Glass

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Laser Cutting of 3D-Shaped Glass

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Corning Laser Technologies GmbH

- Based in Krailling near Munich, Germany, with >125 employees, Corning Laser Technologies (CLT) offers a global service network and world-wide technology collaborations within Corning Incorporated
- CLT has over 25-years experience in designing and integrating customized laser-based tools into production environments, and has been focusing on laser glass cutting and processing technology since 2012
- CLT was acquired by Corning in 2014, which allowed for Corning's deep understanding of material sciences to be combined with CLT's laser glass cutting abilities
- CLT offers a robust portfolio of laser glass cutting and laser processing technologies to meet growing market demands for specialty glass



Laser Cutting Glass in 3D

Modern Displays – Emerging Customer Expectations

Especially in the automotive sector, we see the following display trends:

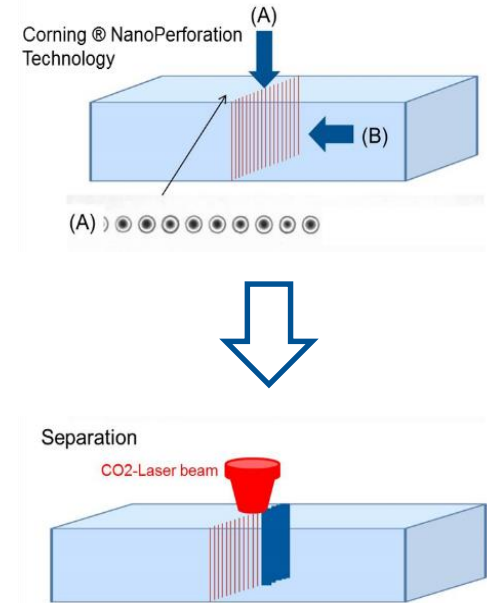
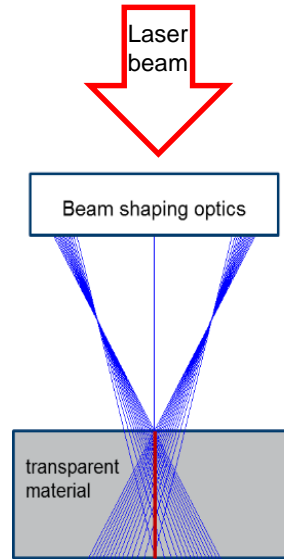
- Free-form designs
- Curved displays and cover glasses
- Inner features (e.g. holes for knobs, sensors, USB socket etc.)
- For a quality look and feel, glass is the material of choice



Proprietary Corning® nanoPerforation Glass Cutting Technology

Corning® nanoPerforation

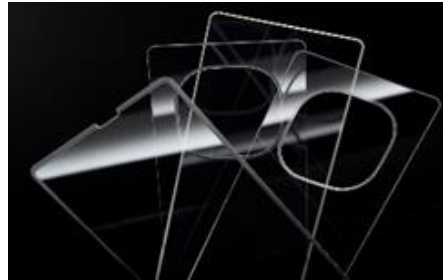
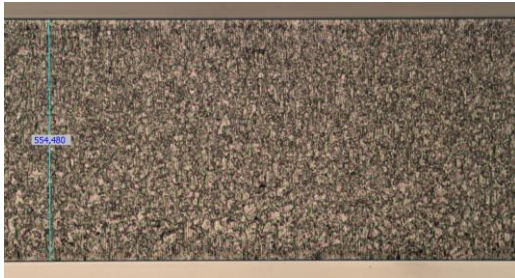
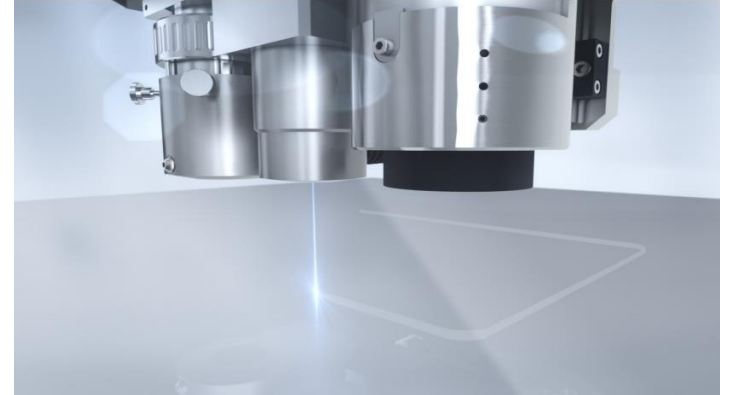
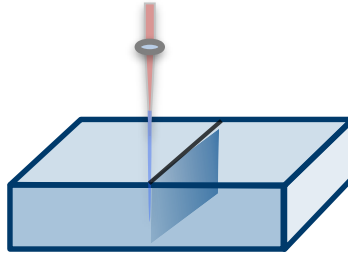
- An ultrashort pulsed laser is used to perforate the glass using a non-linear process
- It induces a localized material modification rather than material removal
- This process provides a singular, high-intensity interaction zone, differing from multi-pass focusing, Kerr self-focusing phenomena, and optical confinement
- Combined with subsequent Laser-induced thermal stress → separates glass accurately



Patented (EP2754524B1 and others)

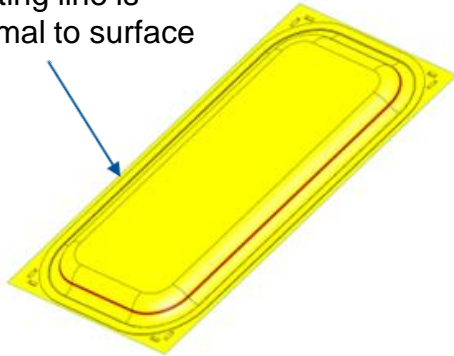
Proprietary Corning® nanoPerforation Glass Cutting Technology

- The process separates the glass **all the way through** the entire thickness
- Result: **High-Quality Cut**
 - Precise and accurate cutting
 - No taper
 - Minimal material loss and debris
 - Minimal surface roughness (Ra typ. +/-1.5 μm)
 - Highest uniformity

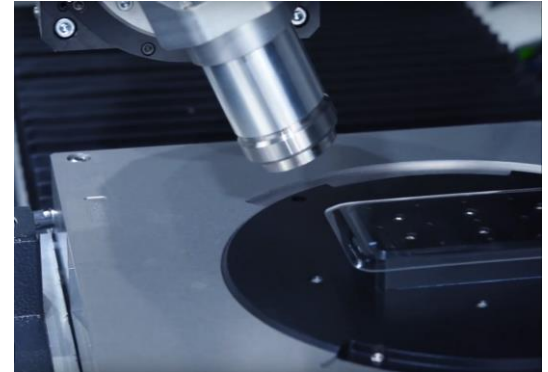
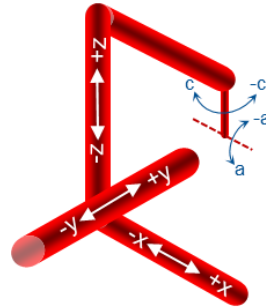


Laser Cutting of 3D-Shaped Glass: Taking the nanoPerforation Process to the 3rd Dimension

Cutting line is normal to surface



Solution:
5-axis system



- The two additional swivel/rotation axis for the beam delivery allow to cut any arbitrarily 3D-shaped part
- Since we use the same nanoPerforation and subsequent CO₂-Laser separation process as for 2D processing, we achieve the same high-quality cut
- Sophisticated measurement technology (e.g. contactless height profiling) and path deviation compensation (to deal with tolerances of 3D-shaped part) enable high accuracy and precision
- 3D processing volume in production machine CLT43D: 1,200 x 700 x 300mm³
- Technology is scalable for larger 3D designs and high-volume production

Laser Cutting of 3D-Shaped Glass: Tool and Process

We demonstrated the path from proof-of-principle (2018) to a fully integrated 5-axis tool and laser process to cut 3D-shaped parts

Unique features

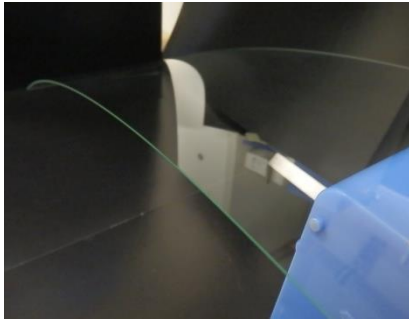
- Laser process head moves according to the 3D cutting contour as opposed to moving the work piece against a fixed laser beam
 - High accuracy
 - High processing speed
 - High design flexibility
- Additional equipment options for automation and glass waste management



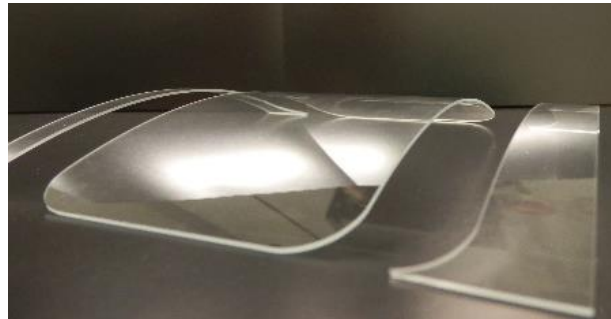
Technical data - CLT43D

- 5-axis system
- 3D-processing envelope:
1,200 x 700 x 300mm
- Glass thickness up to 2mm
- 2.8m x 3.1m x 2.4m (LxWxH)

Cutting 3D-Shaped Glass: Examples



Size: ~800x200x0.7mm,
R=800mm



“C-shape” demo part



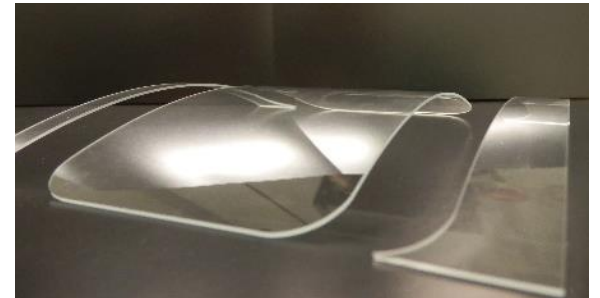
Microscope picture of
0.7mm edge

Our laser cutting process works very well for both chemically strengthened and non-strengthened materials and delivers similar high edge quality compared to 2D-processing

Summary

The nanoPerforation process provides in the 3D-space the same benefits as in flat glass processing

- Flexible and fast cutting of complex geometries in 2D & 3D including inner contours
- Highly accurate and precise process
- Net-shape or near net-shape cutting with no or little need for post-processing
- Minimum to no debris generation
- Low cost of ownership, low cost of maintenance (contactless process, no fluids, no consumables, no wear & tear)
- High throughput and high yield
- Proven in industrial 24/7 high volume production



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