Waterjet Guided Laser

Synova S.A. has invented and patented a unique, new, laser process: the waterjet guided laser, named by its inventors Laser-Microjet® or LMJ. The laser beam is guided loss-free inside a hair-thin low-pressure waterjet, by total reflection at the air-water interface, allowing an unsurpassed cutting quality, far superior to traditional lasers, while avoiding heat damage, deposition and material changes.

Synova provides fully automatic laser cutting, dicing and edge grinding systems for the semiconductor, electronic, medical, energy, and automotive industries.

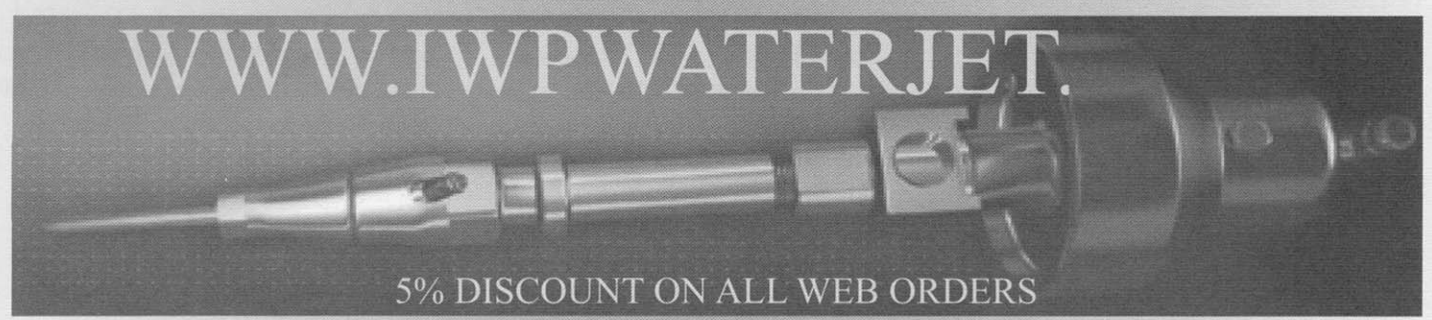
Photographs 01, 02, and 03 below illustrate the waterjet guided laser process. The remaining seven photographs illustrate waterjet guided laser applications.

The Laser Dicing System (LDS) is a laser machining system applying the waterjet guided laser technology, perfectly adapted to dicing wafers. Additionally, the LDS can be used for edge grinding,

(continued on page 13)

Laser
Focusing lens
Window
Water
Water chamber
Nozzle
Work piece
Laser guided by total internal reflection
Water jet

©Synova SA. Principle of the waterjet guided laser.



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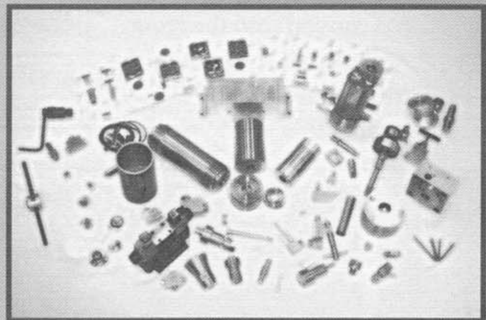

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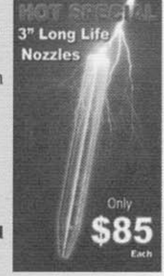

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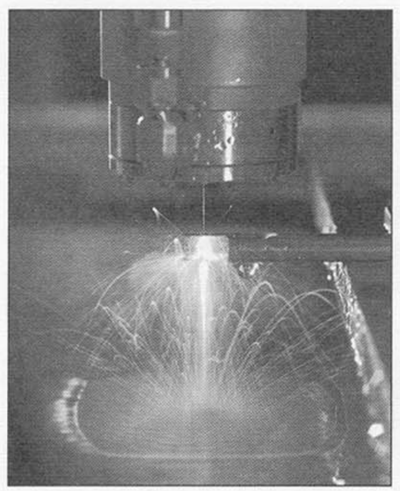
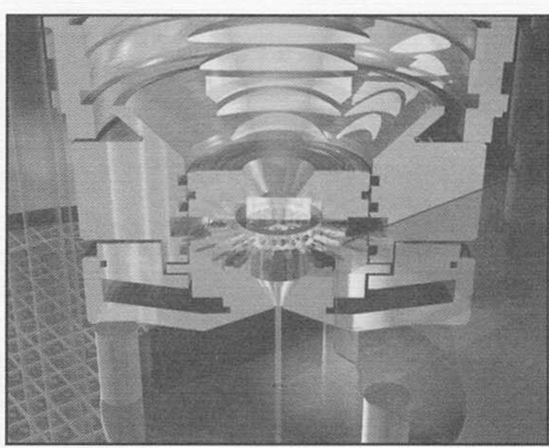
Waterjet Guided Laser, from page 9

hole drilling, slotting, grooving, inking, isolating, and marking. Materials cut are Silicon, Gallium Arsenide, Germanium, Indium Phosphate, and other compound semiconductor materials. Wafers are fixed on laser-dicing tape (Laser-Tape®) then placed on a vacuum chuck. The machine can process wafers from 1 inch to 8 inches in diameter. A 12-inch (300mm) laser dicing system is also available (LDS 300).

Synova SA, founded in 1997, manufactures cutting-edge laser systems based on the waterjet guided laser technique, which was invented by the founder in the early nineties at the Federal Institute of Technology in Lausanne, Switzerland. The technology was subsequently patented by Synova's owners.



©Synova SA. Tube processing with the waterjet guided laser.



©Synova SA. Coupling water and laser, basic principle.

For more information, visit www.synova.ch, or contact Synova SA, Chemin de la Dent d'Oche, 1024 Ecublens, Switzerland, phone: +41 21 694 35 00, fax: +41 21 694 35 01.

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(pictures continued on page 22)

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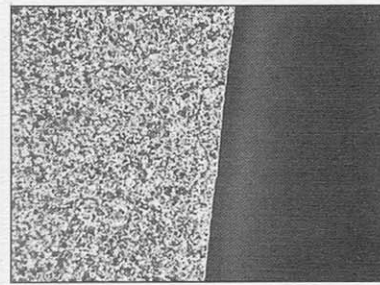
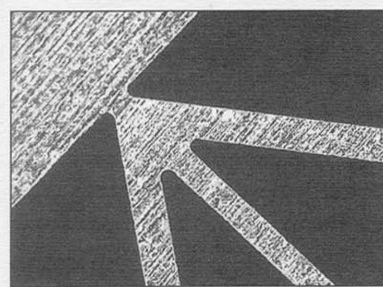
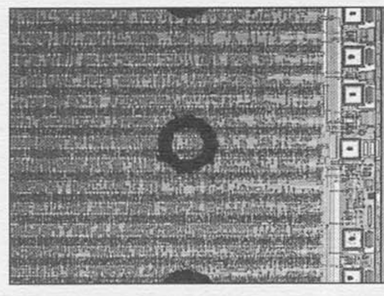
Waterjet Guided Laser, from page 13



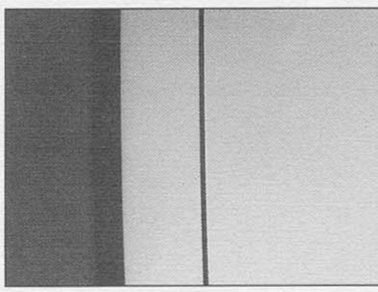
©Synova SA. Insert in polycrystalline diamond (PCD) (tooling). Through-cut of a 0.5 mm thick PCD layer, back side; a green laser has been used (wavelength 532 nm, average power 80 W) and the nozzle diameter was 40 um; cutting speed: 10.9 mm/min.



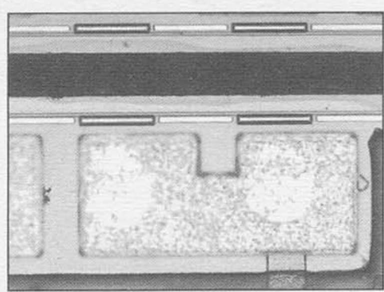
©Synova SA. Stents are employed to improve and ensure the blood flow in human blood vessels affected by insufficient width due to arteriosclerosis or other vascular afflictions (medical device). Detail of a stent structure realized in stainless steel (thickness: 250 um), directly after cutting (no post-processing).



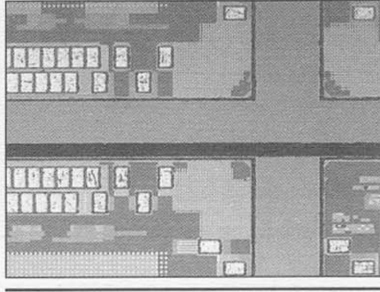
©Synova SA. Marking – Process used to mark defective chips after detection (semiconductors). Ring marking (diameter 400 um, 2 mm between the marks) using a 50-um nozzle; speed: 8 marks/second.



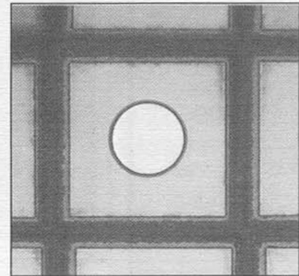
©Synova SA. Edge Grinding – Removal of the wafer edge (containing micro cracks) to reduce thin wafer breakage (semiconductors). Grooving in a 725-um thick silicon wafer, before back grinding, 1 mm from the edge; infrared fiber laser (wavelength 1064 nm, average power 80 W); 75-um nozzle; grooving depth 80 um; grooving speed 50 mm/s.



©Synova SA. Gallium arsenide (GaAs) is a III-V compound semiconductor presenting several advantages over silicon (semiconductors). Dicing of a 100-um thick wafer; Nd:YAG laser (wavelength 1064 nm, average power 50 W); 25-um waterjet; cutting speed 60 mm/s; kerf width 26 um.



©Synova SA. Low-K – The upper layers of low-K wafers have a low dielectric constant, and are very brittle (semiconductors). 100-um thick low-k wafer diced at a speed of 50 mm/s; the cut is very close to the die (between 3 and 5 um); kerf width 30 um.



©Synova SA. Silicon carbide (SiC) is another brittle III-V compound semiconductor (semiconductors). Through-cutting of a 70-um thick SiC wafer; kerf width 25 um.

American Waterjet Conference

Preliminary Schedule Of Events

Sunday, August 21, 2005

8:00 a.m. - Noon	Short Courses*
Noon - 1:30 p.m.	Luncheon For Short Course Participants*
1:30 p.m. - 5:00 p.m.	Short Courses (continued)
6:30 p.m. - 9:30 p.m.	Welcoming Reception In The Exhibit Hall -- Exhibit Officially Opens*

Monday, August 22, 2005

8:00 a.m. - 10:00 a.m.	Live Demonstrations
10:00 a.m. - 11:30 a.m.	Poster Session in Exhibit Hall
10:00 a.m. - 5:00 p.m.	Exhibits Open
11:30 a.m. - 1:00 p.m.	Lunch In Exhibit Hall*
1:30 p.m. - 5:00 p.m.	Research and Development Paper Presentations
2:00 p.m. - 3:00 p.m.	Contractor Topic
5:00 p.m. - 6:00 p.m.	WJTA Membership Meeting
7:30 p.m. - 10:30 p.m.	Awards Presentation/ Party*

Tuesday, August 23, 2005

8:00 a.m. - 10:00 a.m.	Live Demonstrations
10:00 a.m. - 11:30 a.m.	Poster Session in Exhibit Hall
10:00 a.m. - 3:00 p.m.	Exhibits Open
11:30 a.m. - 1:00 p.m.	Luncheon In Exhibit Hall*
1:30 p.m. - 5:30 p.m.	Research and Development Paper Presentations
1:00 p.m. - 2:00 p.m.	Contractor Topic

*Ticket will be required.