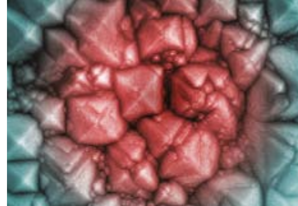
EXAMPLES OF INDUSTRIAL APPLICATIONS

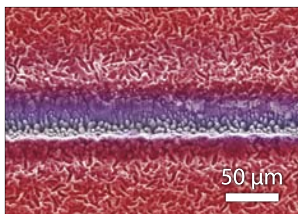
PROCESSING OF SOLAR CELLS

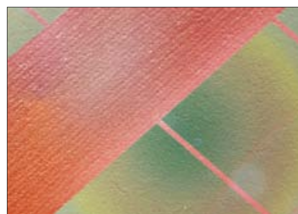
Applications:

- Front contact formation
- Back contact formation

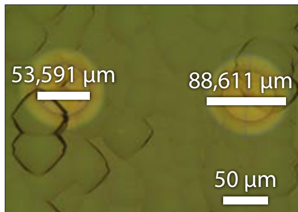


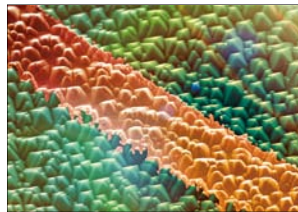
EDGE ISOLATION FOR SOLAR CELLS



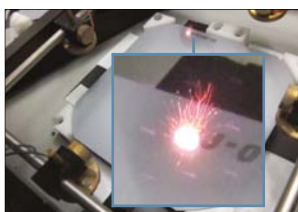


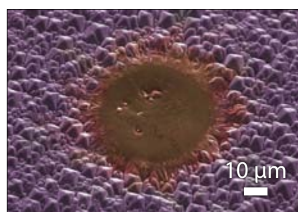
SELECTIVE DIELECTRIC LAYERS REMOVAL FOR SOLAR CELLS





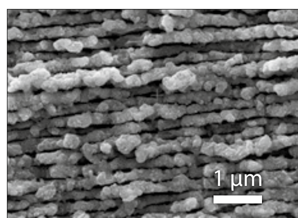
LASER MARKING OF SOLAR CELLS





NANO RIPPLES

- Up to 200 nm ripple period fabricated using ultra-short laser pulses
- Individual nano-feature size on ripples: 10 – 50 nm
- Controlled period, duty cycle and aspect ratio of the ripples



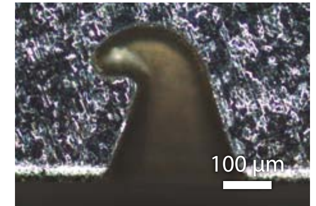
SWIN BUR NE SWINBURNE UNIVERSITY OF TECHNOLOGY Developed in cooperation with Swinburne University, Australia

Application:

- Detection of materials with increased sensitivity using surface-enhanced Raman scattering (SERS)
- Bio-sensing, water contamination monitoring, explosive detection etc.

METAL MICROMACHINING

- 3D structures formed on steel surface
- High precision and surface smoothness achieved



MARKING OF CONTACT LENS

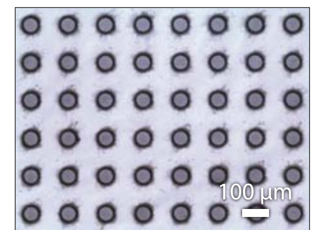
- Marking made inside the bulk of contact lens, preserving surface of lens and distortions
- Exact positioning of markings – 3D text format

Application:

- Product counterfeit protection
- Serial number and customer identification

THIN GLASS DRILLING

- Taper angle control
- Low heat affect
- No cracking or chipping around holes

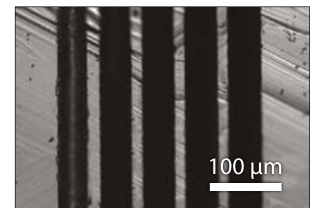


Applications:

- VIAs

DIAMOND CUTTING

- Low carbonization
- No HAZ
- Low material loss

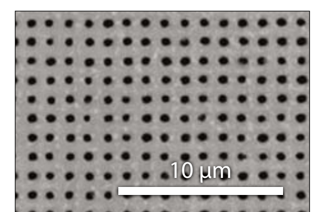


Applications:

- Diamond sheet cutting
- Chip breaker formation
- Diamond texturing/patterning

STEEL FOIL M-DRILLING

- No melting
- Micron diameter



Applications:

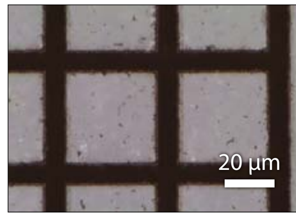
- Filters
- Functional surfaces

FERROELECTRIC CERAMICS ETCHING

- No or low melting and HAZ
- Easily removable debris
- Good structuring quality

Applications:

- Infrared sensors for cameras
- Memory chips

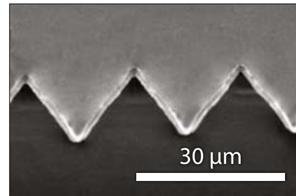


SILICON LASER ASSISTED ETCHING

- No HAZ
- No melting

Applications:

- Solar cell production
- Semiconductor industry

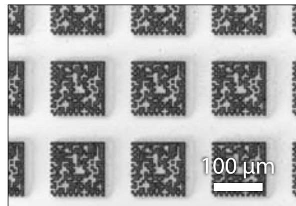


DATAMATRIX

- Data inscribed on a glass surface or inside bulk
- Extremely small elements, down to 5 µm in size

Application:

- Product marking



HOLOGRAM PRODUCTION

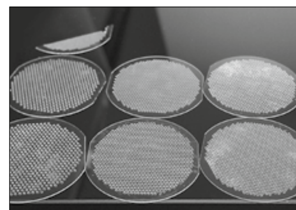
- Example: hologram view generated using glass sample

MASK FOR BEAM SPLITTER PATTERN DEPOSITION

- Borosillicate glass
- 150 um thickness
- ~900 holes per mask
- Mask diameter 25.4 mm

Appplication:

- Selective coating



GLASS TUBE DRILLING

- Controlled damage and depth
- Hole diameter of few microns

Applications:

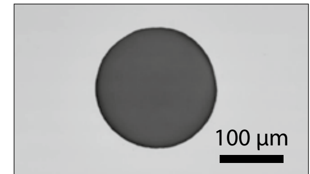
- Medical applications
- Biopsy equipment

GLASS HOLES

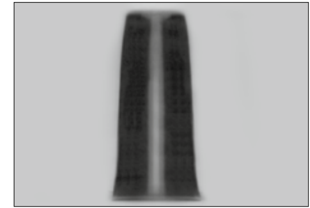
- Various hole sizes with routine tapper angle better than 5 deg
- Minimal debris around the edges of holes

Application:

- Microfluidics
- VIAs



Top view

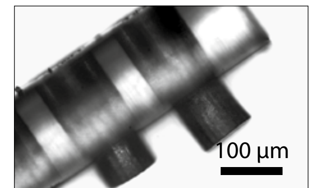

Cross-section

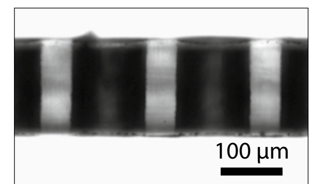
STENT CUTTING

- Holes in stent wall, cross-section view
- Polymer stent
- No heat effect, no debris
- Minimal taper effect

Application:

- Vascular surgery





MARKING AND PATTERNING

- Smallest spots down to 3 µm in width
- Micron level positioning
- No heat effect

Metal

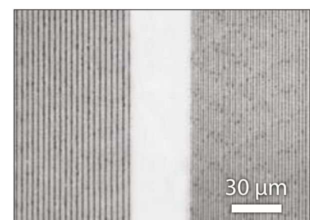
Hair

TEXTURIZED SAPPHIRE SURFACE

- Micron resolution
- Large area processing
- Single pulses used to form craters on the surface

Application:

- Better light extraction in LED
- Semiconductor structure growth

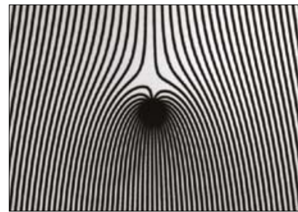


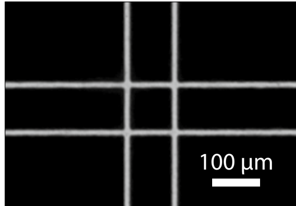
SELECTIVE METAL COATING ABLATION (REMOVAL)

- Selective ablation of metal coatings from various surfaces
- Depth and geometry of ablation may vary

Application:

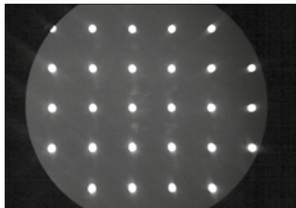
- Lithography mask production
- Beam shaping elements
- Optical apertures
- Other

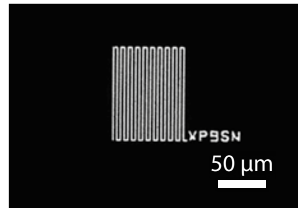

Amplitude grating formation



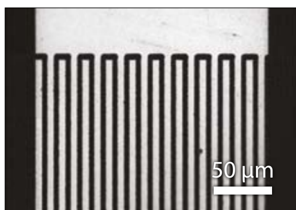
Titan coating selective ablation

Chrome ablation for beam shaping


Apperture array fabrication



Gold layer removal without damage to MgO substrate – Au layer removal without damaging



Chrome ablation from glass substrate

OPTICAL FIBER DRILLED TO THE CORE

- Diameter from <10 µm
- Various hole profiles possible
- Depth and angle control

Applications:

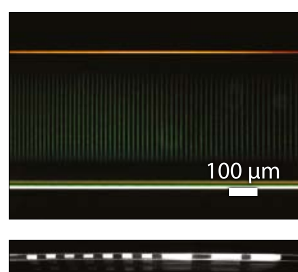
- Optical fiber sensors
- Material science

OPTICAL FIBER SCATTERING

- No impact on fiber strength
- No surface damage
- Even light dispersion

Applications:

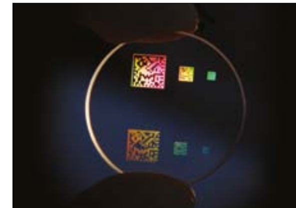
- Medical fibers
- Oncology



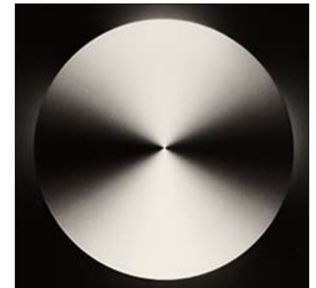
GLASS BULK PROCESSING

- Refractive index volume modification
- Bragg gratings with 99% diffraction efficiency
- Birefringent gratings/elements
- Low influence on strength of the substrate

Birefringence modification inside fused silica. Photo in crossed polarized light


Sapphire

Glass


S-waveplate *

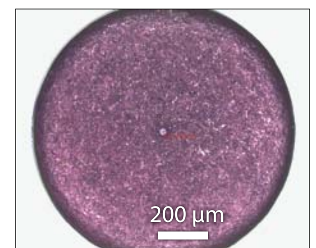
* M. Beresna, M. Gecevičius, P. G. Kazansky and T. Gertus, Radially polarized optical vortex converter created by femtosecond laser nanostructuring of glass, Appl. Phys. Lett. 98, 201101 (2011).

SYNTHETIC RUBY DRILLING

- No cracks after drilling
- Taper angle control

Application:

- High precision mechanical parts

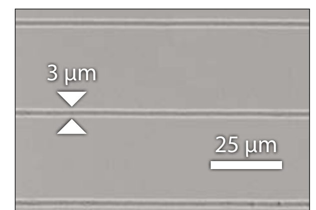


MICRO CHANNEL FORMATION

- Wide range of materials – from fused silica to polymers
- Controllable channel shape
- Low debris
- Smooth surface

Applications:

- Microfluidic sensors
- Waveguides



ULTRAFAST LASERS

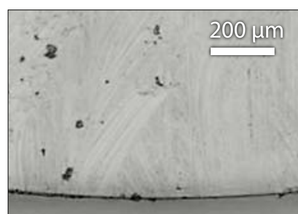
SAPPHIRE CUTTING

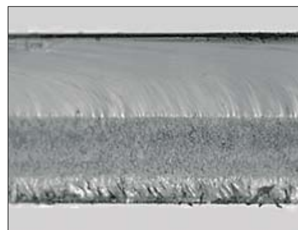
- Thickness: 100 – 900 µm
- Easy to break
- Circle shapes diameter: 3 – 15 mm
- Corner radius: from 0.5 mm
- Speed: up to 800 mm/s
- Cut quality: Ra ≤ 2 µm
- No surface cracks
- No or low chipping
- Non ablating process

Thickness: 420 µm, clear sapphire

TEMPERED GLASS CUTTING

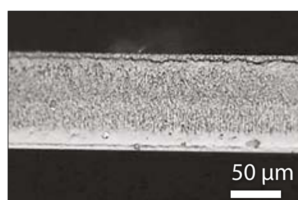
- Single pass process
- In bulk damage (closed cut), surface remains intact, practically no debris
- Homogeneous cut surface





NON TEMPERED GLASS CUTTING

- Thickness: 0.03 – 0.3 mm
- Mechanical or heat assisted break after scribing
- Speed: up to 800 mm/s
- Any shape
- Round corners
- Surface quality: Ra ≤ 2µm



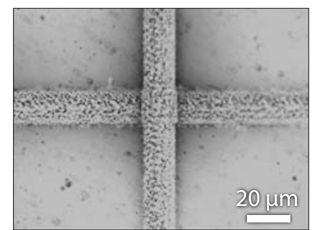
Samples provided by
Workshop of Photonics
www.wophotonics.com

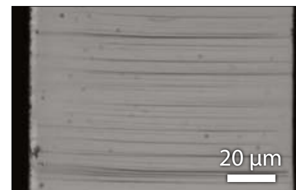
SILICON CARBIDE DICING

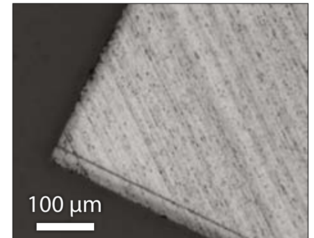
- No chipping on the edges
- Cleaved-surface roughness <1 µm
- Easy breaking

Applications:

- High power, high frequency electronics

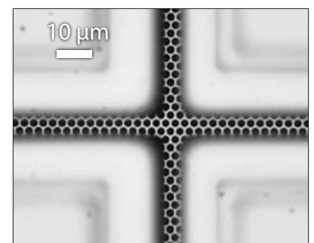


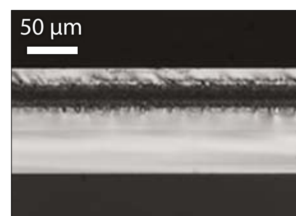


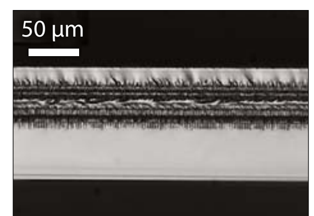


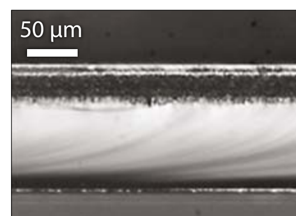
SAPPHIRE DICING FOR LED INDUSTRY

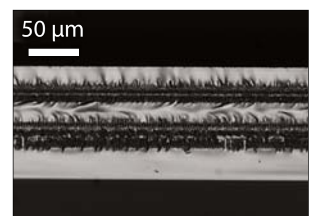
- Wafer thickness 50 to 330 µm
- Narrow street width up to ~10 µm
- Bending strength (650–900 MPa)
- High light extraction efficiency
- Controllable damage length
- Easy breaking
- Scribing with DBR coated backside of sapphire

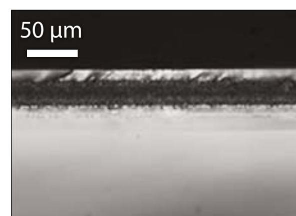


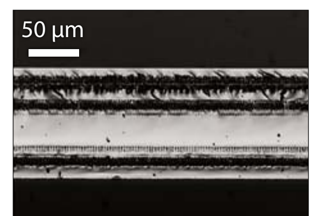












Samples provided by
Evana Technologies
www.evanatech.com

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