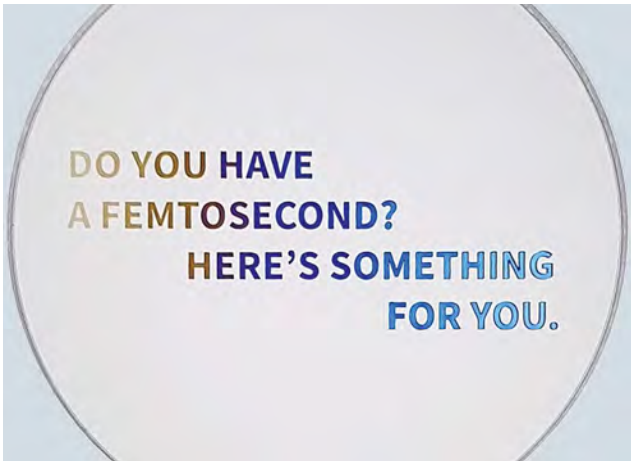
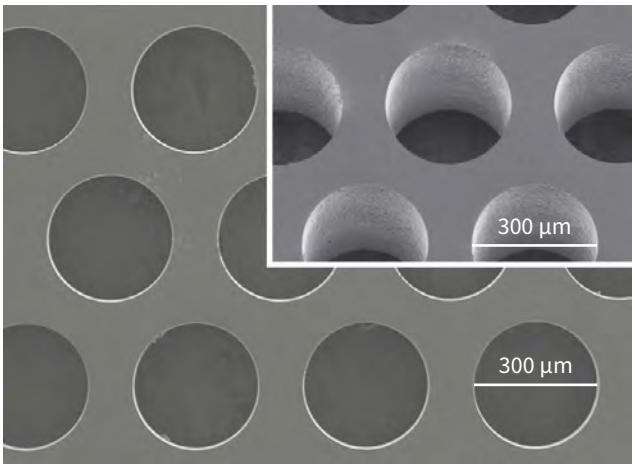
Examples of Industrial Applications

Birefringent volume modifications in glass



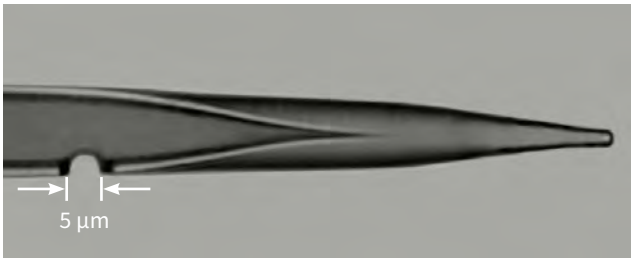
Form induced birefringence-retardance variation results in different colors in parallel polarized light.
Source: Workshop of Photonics.

High precision glass drilling



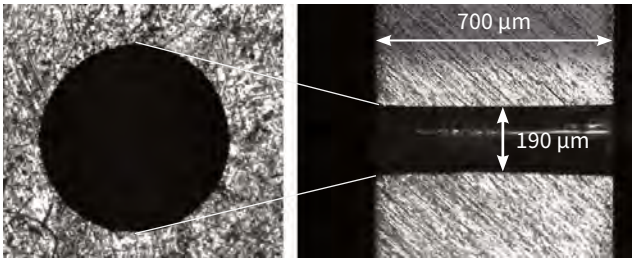
Various glass drilling.
Source: Workshop of Photonics.

Glass needle microdrilling



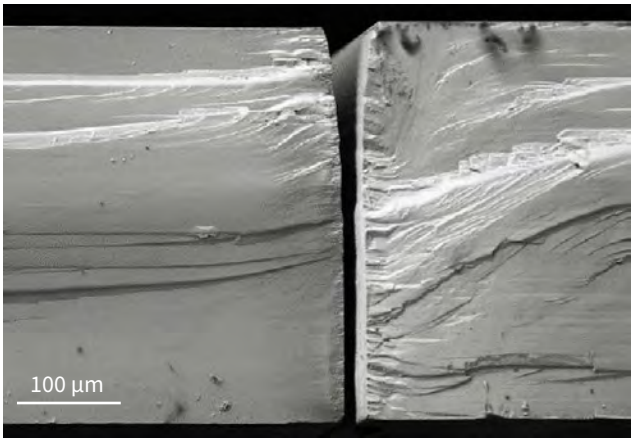
Glass needle microdrilling.
Source: Workshop of Photonics.

Steel drilling



Taperless hole microdrilling in stainless steel alloys.
Source: Workshop of Photonics.

Brittle & highly thermal-sensitive material cutting



Multi-pass cadmium tungstate cutting.
No cracks. All thermal trace effects eliminated.
Source: Micronanics Laser Solutions Centre.

Stainless steel stent cutting

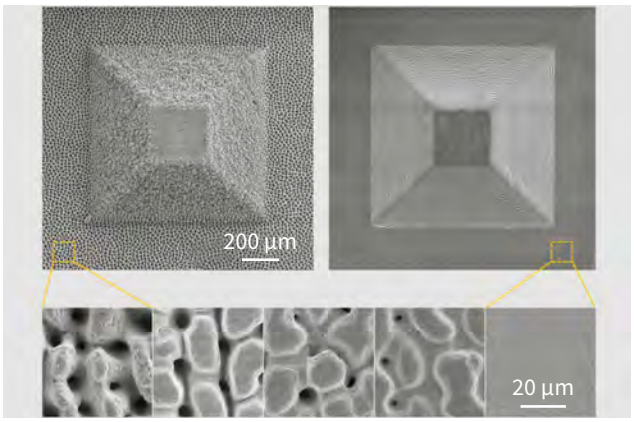
Stent cut using CARBIDE laser.
Source: Amada Miyachi America.

Milling of complex 3D surfaces

3D milled sample in copper. Zoom in SEM image.

Source: “Highly-efficient laser ablation of copper by bursts of ultrashort tuneable (fs-ps) pulses”, A.Žemaitis, P.Gečys, M.Barkauskas, G.Račiukaitis, M.Gedvilas. Scientific Reports (2019).

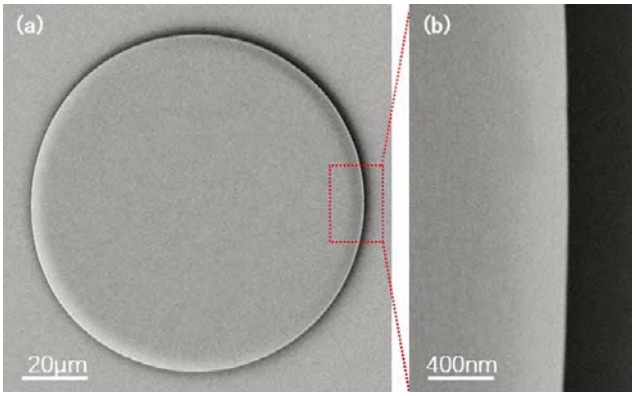
Stainless steel polishing



SEM image collage of structures ablated in stainless steel, before and after laser polishing using GHz burst (from left to right).

Source: “High quality surface treatment using GHz burst mode with tunable ultrashort pulses”, D.Metzner , P.Lickschat and S.Weißmantel. Applied Surface Science (2020).

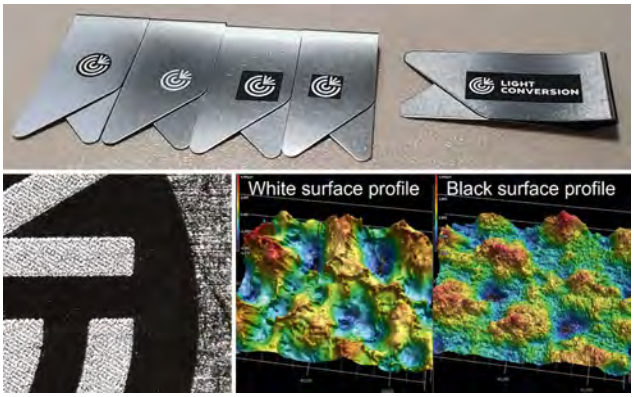
Selective ablation



Lithium niobate microdisks fabricated using selective ablation.

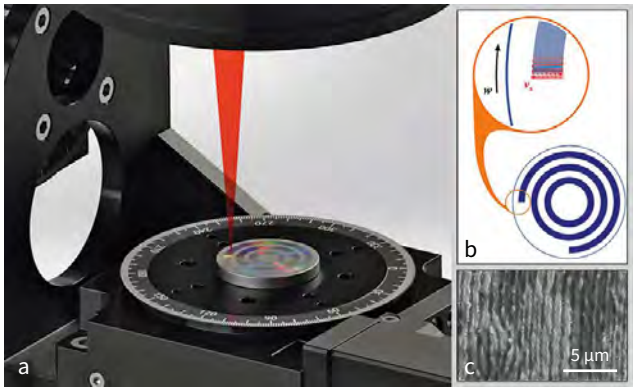
Source: “Fabrication of crystalline microresonators of high quality factors with a controllable wedge angle on lithium niobate on insulator”, J.Zhang, Z.Fang, J.Lin, J.Zhou, M.Wang, R.Wu, R.Gao, Y.Cheng. Nanomaterials (2019).

High-contrast marking



High-contrast black-and-white marking on stainless steel clips using the BiBurst option.

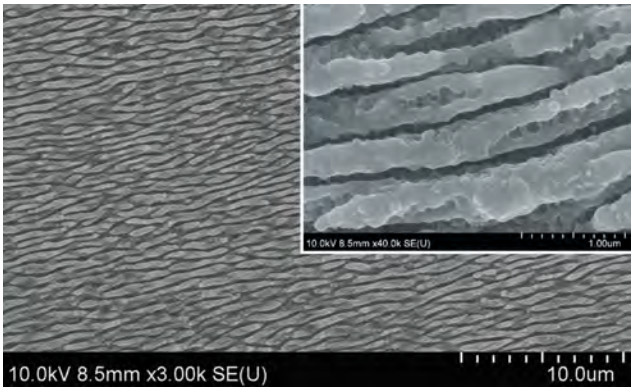
Friction and wear reduction



Schematic of the laser treatment (a), laser patterning strategy (b), SEM image of induced LIPSS (c).

Source: “Tribological properties of high-speed uniform femtosecond laser patterning on stainless steel”, I.Gnilitskyi, A.Rota, E.Gualtieri, S.Valeri, L.Orazi. Lubricants (2019).

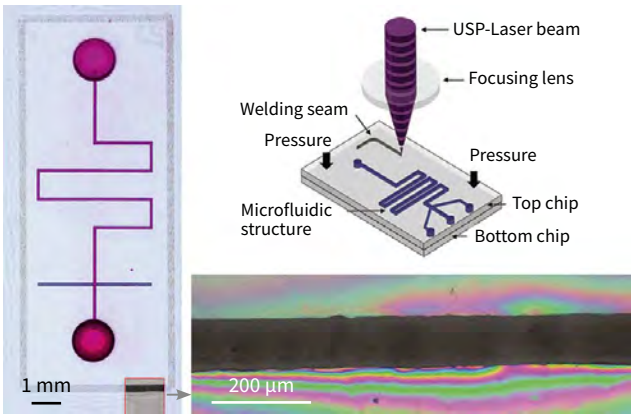
SERS sensor fabrication



SEM image of the Ti-6Al-4V (TC4) surface after irradiation with progressive laser scan.

Source: “Large-scale fabrication of nanostructure on bio-metallic substrate for surface enhanced Raman and fluorescence scattering”, L.Lu, J.Zhang, L.Jiao, Y.Guan. Nanomaterials (2019).

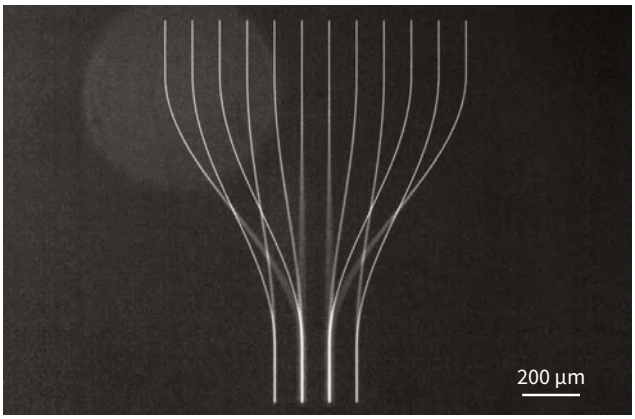
Lab-on-chip channel ablation and welding



Welding of transparent polymers for sealing of microfluidic devices. Top view on a sealed microfluidic device (left), welding seam (bottom right).

Source: "A new approach to seal polymer microfluidic devices using ultrashort laser pulses", G. Roth, C. Esen and R. Hellmann. JLMN-Journal of Laser Micro/Nanoengineering (2019).

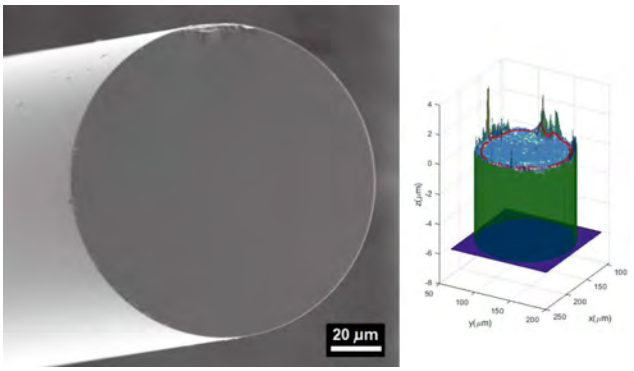
3D waveguides



3D waveguides fabricated in fused silica glass.

Source: Workshop of Photonics.

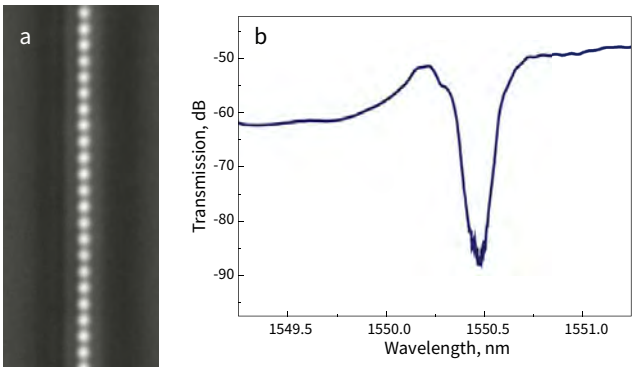
Fiber cleaving



Fiber end face after laser-based scribing (left) and its surface profile (right).

Source: RMIT University, Melbourne.

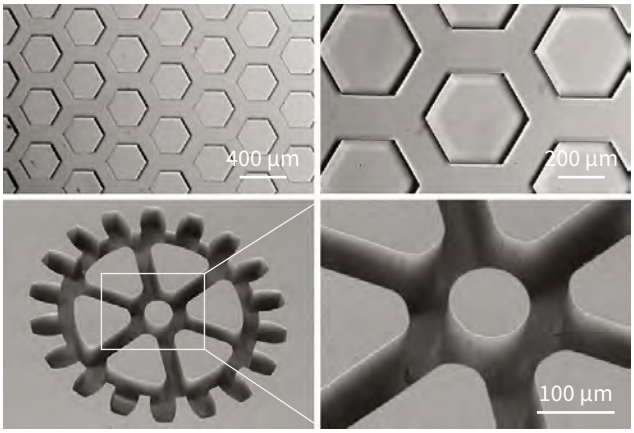
Bragg grating waveguide (BGW) writing



First-order Bragg gratings inscribed in waveguide (a). Resonant spectral transmission of inscribed BGW (b).

Source: "Ultrashort Bessel beam photoinscription of Bragg grating waveguides and their application as temperature sensors", G.Zhang, G. heng, M.Bhuyan, C.D'Amico, Y.Wang, R.Stoian. Photon. Res. (2019).

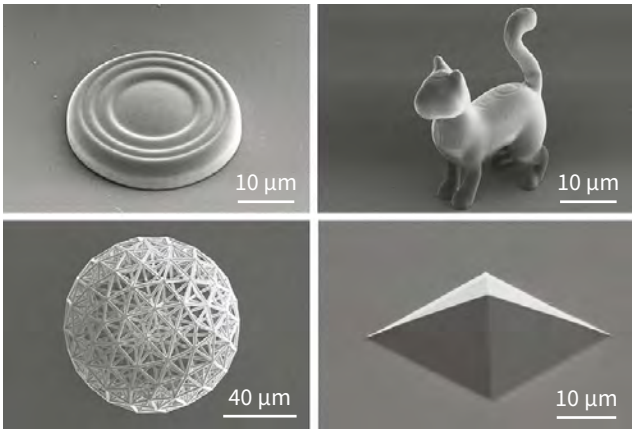
3D glass etching



Various structures fabricated in fused silica glass.

Source: Femtika.

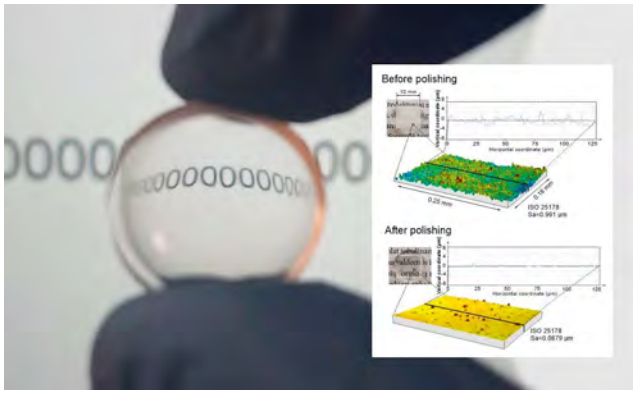
3D multiphoton polymerization



Various 3D structures fabricated in SZ2080 polymer using multi-photon polymerization.

Source: Workshop of Photonics.

Polymer polishing



Polished curved surface and surface roughness measurements before and after polishing with GHz BiBurst.

Source: “Micromachining of Transparent Biocompatible Polymers Applied in Medicine Using Bursts of Femtosecond Laser Pulses”, E. Kažukauskas, S. Butkus, P. Tokarski, V. Jukna, M. Barkauskas, V. Sirutkaitis. Micromachines (2020).

QR code marking

High contrast QR codes markings on various samples. Size 3 × 3 mm. Sky-writing mode enabled.

Source: Light Conversion apps lab.

Color center formation

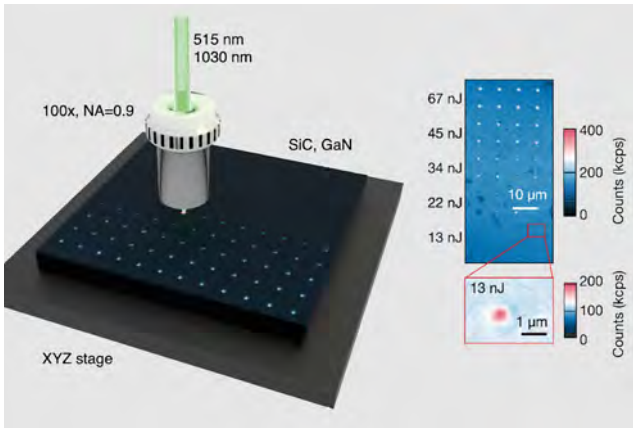
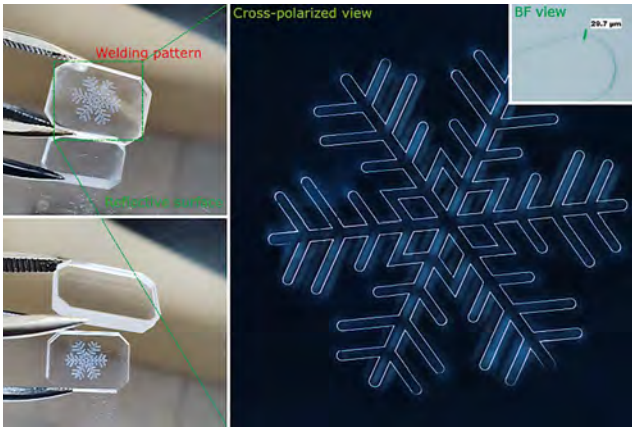


Illustration of the laser writing of color centers (left), silicon carbide containing arrays of laser-written color centers (right).

Source: “Color Centers Enabled by Direct Femto-Second Laser Writing in Wide Bandgap Semiconductors”, S. Castelletto, J. Maksimovic, T. Katkus, T. Ohshima, B.C. Johnson, S. Juodkazis. Nanomaterials (2020).

Glass welding

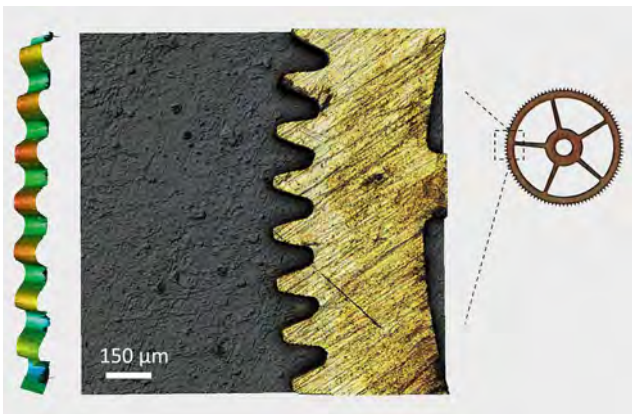


Example of 1 mm thick fused silica glass welding.

Glass cutting

Example of glass cutting. Source: Citrogene.

Precision parts cutting from brass



Example of gear cut from brass. Source: Lasea.