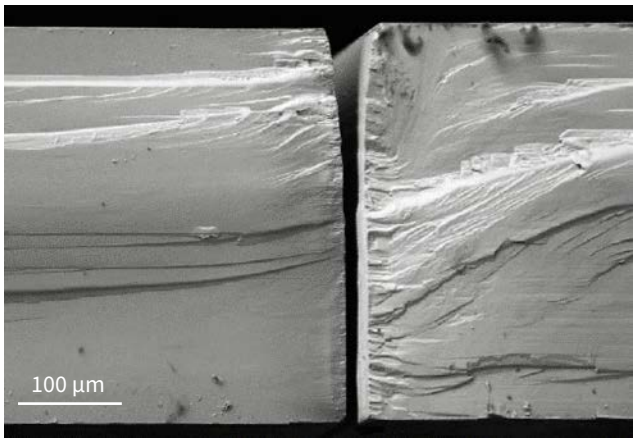
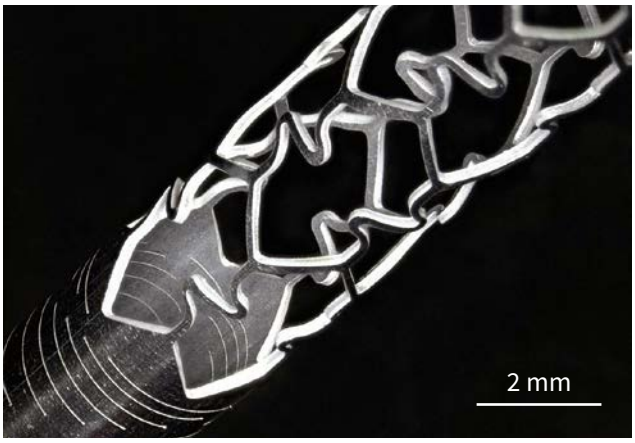
EXAMPLES OF INDUSTRIAL APPLICATIONS

Brittle & highly thermal-sensitive material cutting



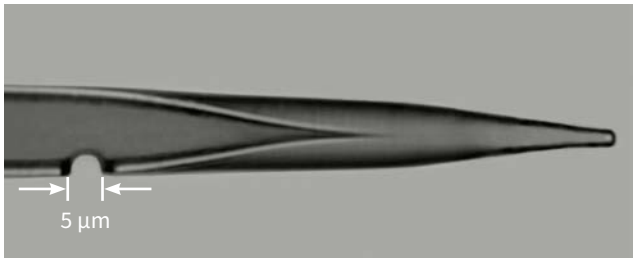
Multi-pass cadmium tungstate cutting.
No cracks. All thermal trace effects eliminated.
Source: Micronanics Laser Solutions Centre.

Stainless steel stent cutting



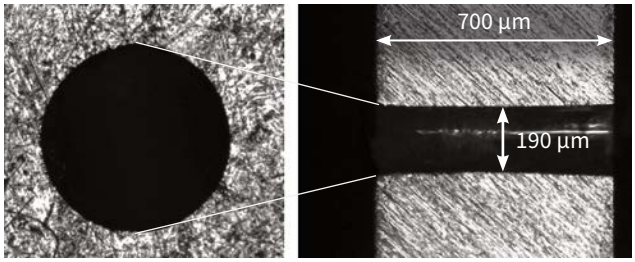
Stent cut using CARBIDE laser.
Source: Amada Miyachi America.

Glass needle microdrilling



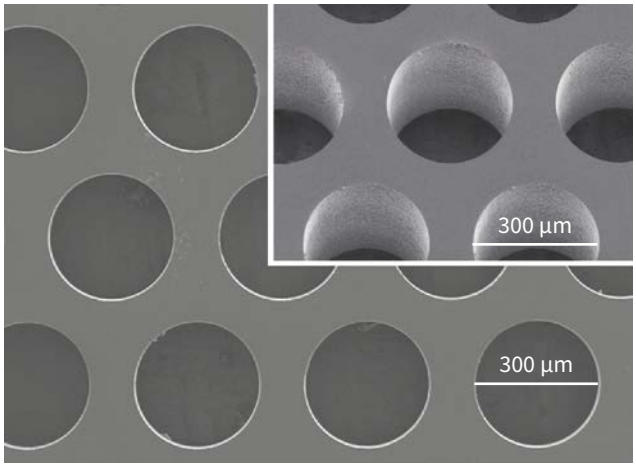
Glass needle microdrilling.
Source: Workshop of Photonics.

Steel drilling



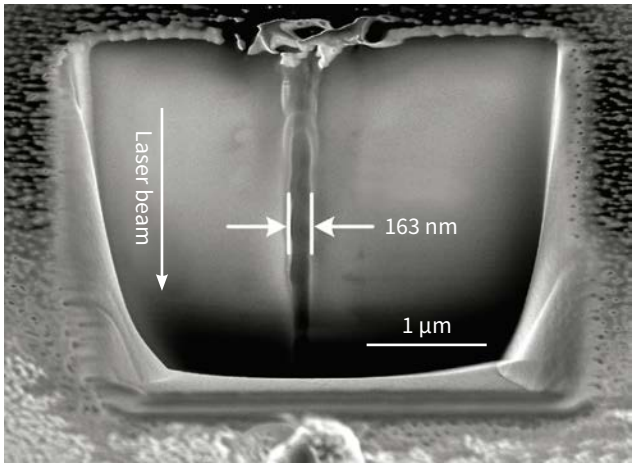
Taperless hole microdrilling in stainless steel alloys.
Source: Workshop of Photonics.

Various type glass drilling



Various glass drilling.
Source: Workshop of Photonics.

Nanodrilling of fused silica



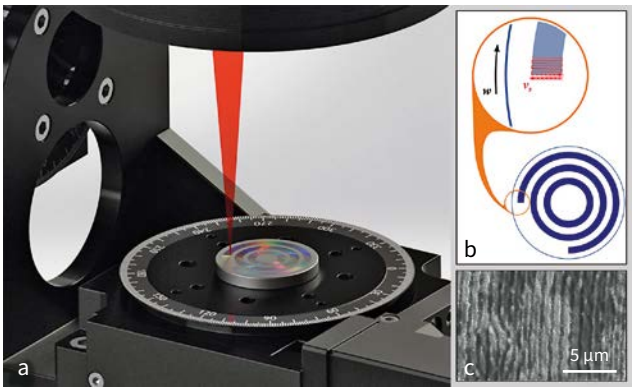
Longitudinal section of a single void.
Source: "Ultrashort Bessel beam photoinscription of Bragg grating waveguides and their application as temperature sensors", G. Zhang, G. Cheng, M. Bhuyan, C. D'Amico, Y. Wang, R. Stoian. Photon. Res. (2019).

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).

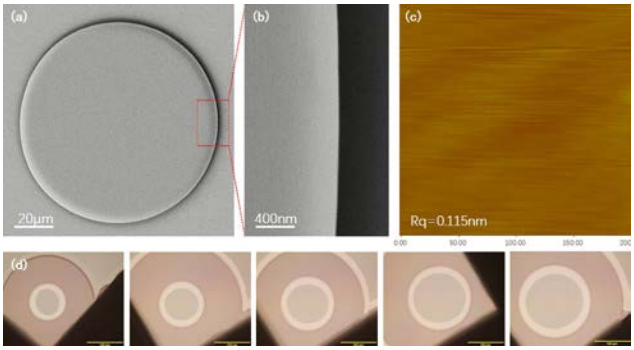
Friction and wear reduction



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

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).

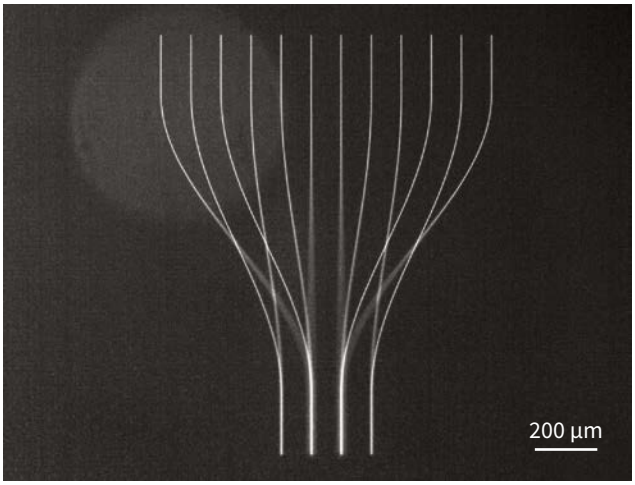
Selective Cr thin film ablation



Cr thin film ablation for creation of $LiNbO_3$ micro-disk resonator. (a,b) SEM images, (c) AFM image of micro-disk wedge, (d) optical images of micro-disk resonators with different diameters.

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).

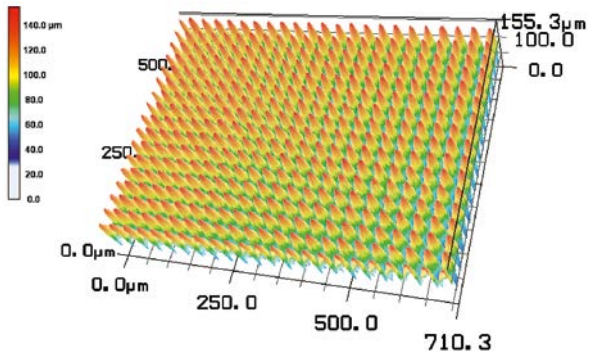
3D waveguides



3D waveguides fabricated in fused silica glass.

Source: Workshop of Photonics.

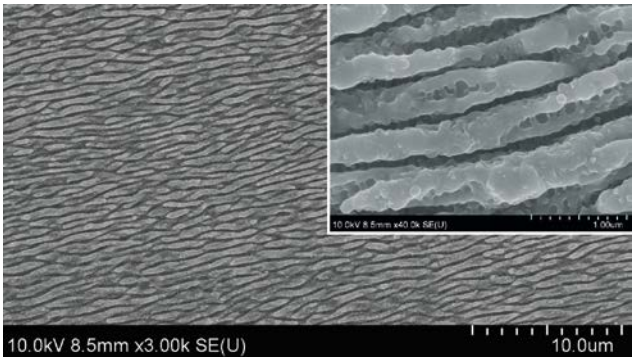
Terahertz broadband anti-reflection structures



Fabricated moth-eye 3D profile, taken by laser scanning microscope.

Source: "Terahertz broadband anti-reflection moth-eye structures fabricated by femtosecond laser processing", H.Sakurai, N.Nemoto, K.Konishi, R.Takaku, Y.Sakurai, N.Katayama, T.Matsumura, J.Yumoto, M.Kuwata-Gonokami. OSA Continuum (2019).

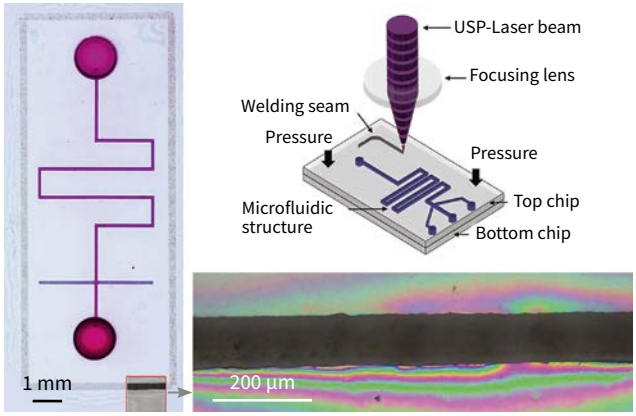
Surface-enhanced Raman scattering (SERS) sensors fabrication



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).

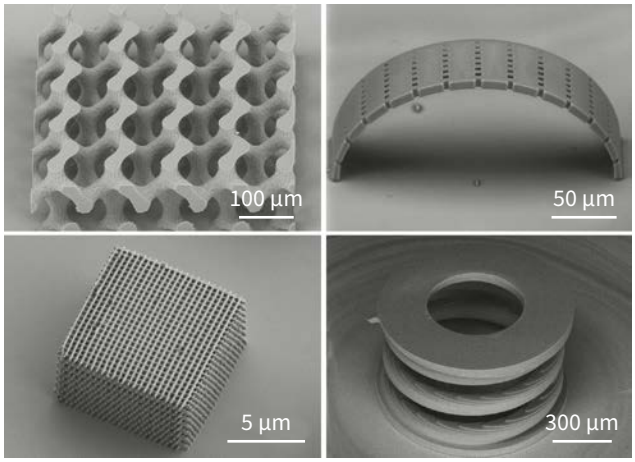
Lab-on-chip channel ablation and welding



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).

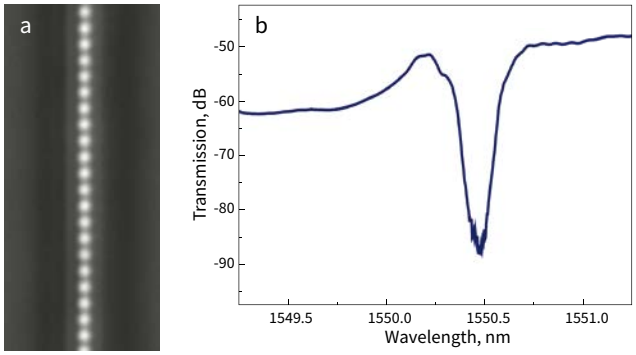
3D micro printing using multi-photon polymerization



Various 3D structures fabricated in SZ2080 polymer using multi-photon polymerization – nanophotonic devices, microoptics, micromechanics.

Source: Femtika.

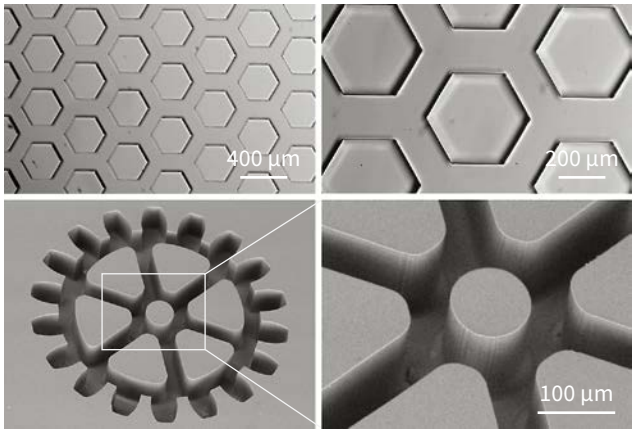
Bragg grating waveguide (BGW) writing



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

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.

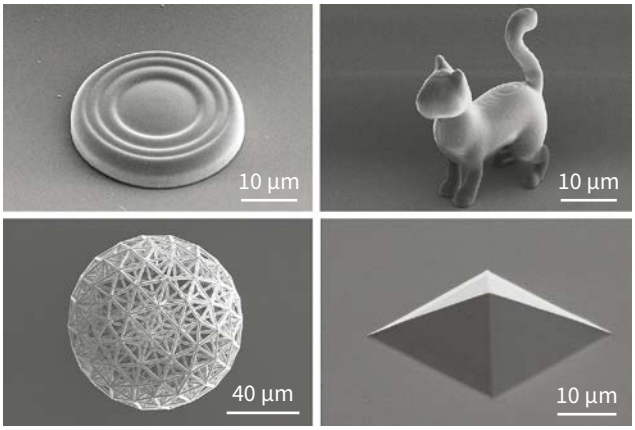
Source: Femtika.

Birefringent glass volume modifications

Form induced birefringence-retardance variation results in different colors in parallel polarized light.

Source: Workshop of Photonics.

3D multi-photon polymerization



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

Source: Workshop of Photonics.