International Workshop on Frontiers in Lasers and Applications (FLA 2018) from April 16th to 19th, 2018 Ishigaki, Okinawa, Japan

REGISTRATION FORM

REGISTRATION

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TOTAL PAYMENT

	Unit fee (JPY)	Number of persons	Total (JPY)
Full registration	65,000	1	65,000
Excursion for accompanying person	4,000		
Banquet for accompanying person	8,000		
Total (JPY)			65,000

(JPY=Japanese Yen, tax included)

(payment deadline: January 19, 2018)

SPECIAL REQUIREMENT

- Number of vegetarian menu for banquet: 0

Ultrafast laser processing of dielectrics: Beyond single shot Bessel beams

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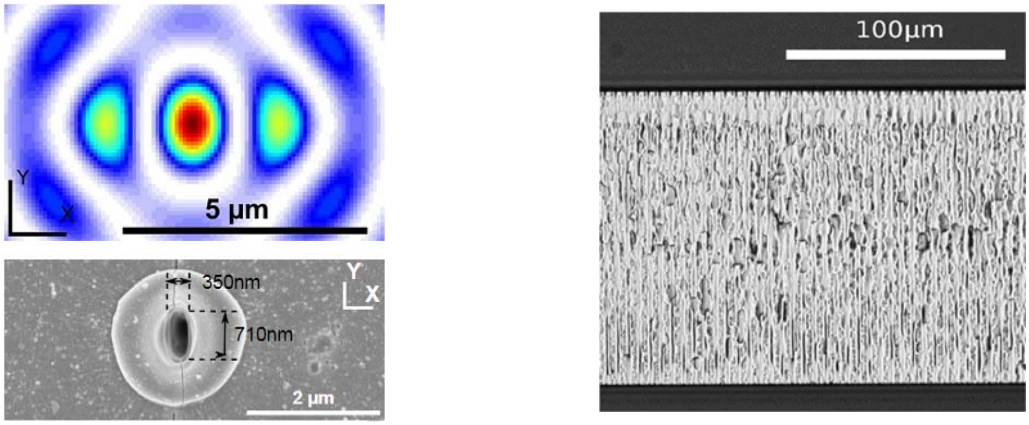
Ultrafast lasers have been a revolution in a number of areas of science and technology. In materials processing, the ultrafast pulse duration brought the ability to deposit energy into the free-electron gas before it couples to the lattice and therefore generate extremely steep thermodynamic gradients. A second benefit is the ultra-high peak power which allows for ionizing dielectrics, even from the bulk material. The processing of glass and sapphire is of particular importance for several technological applications to mass fabrication (consumer electronics, microelectronics, etc). In this field, nondiffracting Bessel beams have brought the ability of controlling energy deposition by a single laser pulse on a long propagation distance inside dielectrics. In particular, this has allowed avoiding nonlinear instabilities generated by the filamentation regime of Gaussian beams yielding inhomogeneous damage in materials [1].



(a) (b)

Figure 1 (a) (top) cross section of the elliptical Bessel beam developed. (bottom) Elliptical cross section of a nanochannel produced. (b) Side imaging of a sample cleaved after elliptical Bessel beam processing.

Here, we report further advances in this field where additional benefit can be found in other beam shapes and pulse sequence. For applications to the so-called "stealth-dicing" technology, where material is cleaved after laser illumination, we have developed elliptical Bessel beams. We have demonstrated these beams remain also propagation-invariant and allow for generating nanochannels with elliptical cross section (Fig. 1(a)) [2]. We have demonstrated those allow for cleaving glass (Fig 1(b)) with enhanced reliability and with sub-µm accuracy [3].
In addition, we will discuss recent novel results where the illumination has been performed by double pulses with equal power. We show that, depending on the initial pulse energy, double femtosecond pulses enhance the ability of channel drilling in glasses. In particular, channels with larger diameters are produced [4]. Energy absorption measurements will be discussed.

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[1] F. Courvoisier, R. Stoian & A. Couairon " Ultrafast laser micro- and nano-processing with nondiffracting and curved beams", Optics Laser Technology, 80, 125-137 (2016)
[2] R. Meyer, et al. "Single-shot ultrafast laser processing of high-aspect-ratio nanochannels using elliptical Bessel beams " Opt. Lett. 42, 4307-4310 (2017)
[3] R. Meyer et al, "Sub-micron-quality cleaving of glass with elliptical ultrafast Bessel beams", Applied Physics Letters 111,231108 (2017)
[4] J. Hoyo et al, in preparation (2018)