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Rapid fabrication of long nanochannels with a single femtosecond laser pulse focused to a line[1] LLOYD M. DAVIS, ALEXANDER TEREKHOV, KATHLEEN LANSFORD, Center for Laser Applications, University of Tennessee Space Institute, JOSHUA W. BRADFIELD, CHARLES A. ROHDE, M. CATHER SIMPSON, BRYON E. WRIGHT, The Photon Factory, University of Auckland —
We have recently reported the use of tight line-focusing of an amplified femtosecond laser beam to fabricate very long, sub-micron wide features in glass with just a single laser pulse [Davis et al., IQEC/CLEO Pacific Rim, August 2011]. The optical configuration used in these experiments presents distinct advantages and can be expected to have numerous applications, including the rapid creation of micro/nanofluidic devices and waveguides. Here we review that work and also discuss recent results on imaging features created at the surface or at various depths internal to a substrate using a number of methods, including SEM images of acetate replicas, atomic force microscope, and optical imaging of sections that show the depths of internal features. We also discuss the physical mechanisms that can occur during femtosecond laser-induced plasma formation under different conditions, while emphasizing the non-linear mechanisms that can produce sub-diffraction features and the use of aberrations and spatio-temporal focusing to control the feature depth.

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