BURST FEMTOSECOND LASER PROCESSING OF 3D PHOTONIC AND OPTOFLUIDIC MICROSYSTEMS

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Nonlinear optical interaction is the new mantra of a rapidly growing and evolving research community harnessing the novel interaction physics of femtosecond laser light. For optically transparent media, such interactions have opened new possibilities for manufacturing three-dimensional (3-D) structures in the micro- and nano-scale on a base of increasingly versatile and reliable ultrashort-pulse laser systems. This talk will explore the practical opportunities emerging from high-repetition rate laser systems and the associated benefits of heat accumulation effect that accelerate process speed, anneal damage, and reduce thermal cycling damage in various transparent glasses and crystals. We survey our progress in writing low-loss 3-D optical circuits, burst drilling of micro-vias and fluidic channels, and laser-assisted HF etching that collectively offer new approaches in the fabrication, integration, and packaging of telecom devices, optical sensors and optofluidic systems. An integrated 5D spectroscopic system is described that enables real-time monitoring of the laser interaction physics for process optimization, high resolution 3D imaging and overlay alignment, device characterization and device tuning.