Microchannels devices fabricated on soda-lime by laser technologies

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In this work, the fabrication of microchannels by direct laser-writing over soda-lime glass with lasers in the nano, pico and femtosecond regimes is presented. Microchannels are the basic structure of the majority of the microfluidic devices. For the manufacturing of these chips, several materials are employed but soda-lime glass outstands among others due to its robustness and chemical resistance [1]. When using soda-lime glass, laser direct-writing is a suitable fabrication technique due to the accuracy and versatility that laser presents [2]. Physical phenomena involved in the ablation of glass in the IR range process depend on the laser pulse duration and, consequently, the morphology of the obtained structures in each case is different. For the fabrication of the channels, three different lasers were employed: a Rofin Nd:YVO₄ Q-switched laser with fundamental wavelength of 1064 nm and 20 ns pulse duration, a Lumera Super Rapid-HE (Nd:YVO₄) with pulse duration of 12 ps and 1064 nm wavelength and in the femtosecond regime, an amplified Ti:Sapphire laser system (Spectra Physics, Spitfire) with a pulse duration of 100 fs and 800 nm. Microchannels with similar dimensions were achieved in the three cases, with diameter around 20 μm and depth of 10 μm. The morphological properties of the ablation channels fabricated by the three approaches were analyzed in detail with SEM and 3D confocal microscopy.

Figure 1: SEM and 3D confocal images of the microchannel fabricated over soda-lime glass using the a) nanosecond, b) picosecond and c) femtosecond lasers.

References