Soda-lime glass machining with GHz bursts using a bottom-up technique

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The burst regime has already shown benefits in machining metal, semiconductor and dielectrics [1]. Most of the studies are done with direct ablation as it allows the ablation of non-transparent materials. However, glasses could also be machined from the bottom side allowing the formation of straight walls [2]. Furthermore, lower damage threshold of the bottom surface [3] and ablated particle removal with the help of shockwave and gravity results in higher cutting speeds [4]. In this work, we investigated the bottom-up machining of soda-lime glass using GHz bursts.

Femtosecond laser Carbide CB3-40W (Light Conversion) emitting 1030 nm wavelength was used in the experiment. The laser source could generate GHz bursts with pulses separated by 404 ps. We investigated different pulse durations and number of pulses per GHz burst for soda-lime glass cutting. The cutting was done with the beam focused on the bottom surface of the 4.8 mm thickness sample. The positioning of the beam in the X and Y axes was achieved with a galvanometer scanner and the Z position was controlled with a linear motor stage. The beam was focused with a 100 mm focal length telecentric f-theta lens.

The burst regime allowed us to achieve ~ mm/s cutting speed on 4.8 mm thickness soda-lime glass. Furthermore, we demonstrated 18 mm thickness sample cutting together with complex contour cutting for 4.8 mm thickness glass. These results show, that bottom-up cutting using a burst regime is a compelling technique for glass processing.

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