LIQUID CRYSTAL CELLS WITH MICROPIXELS GENERATED BY SUB-15 FEMTOSECOND NEAR-INFRARED LASER PATTERNING OF INDIUM-TIN-OXIDE THIN FILM ELECTRODES

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In recent years, liquid crystal (LC) cells gained importance for many applications such as displays and spatial light modulators [1,2]. The most widely used electrode material for liquid crystal cell applications is indium tin oxide (ITO) because of its transparency in the visible spectral range and its high electrical conductivity. We report on a novel concept to construct a twisted nematic LC cell with micropixels without the need of an additional alignment layer. The pixels feature sub-20 nm laser-induced periodic surface structures (LIPSS) with a periodicity of 100 - 250 nm, which were generated in sputter-deposited 150 nm thick ITO thin films on glass substrates using tightly focused high-repetition rate sub-15 femtosecond pulsed Ti:sapphire laser light [3,4]. Spacers of well-defined three-dimensional shape were generated by multiphoton photopolymerization in ma-N 2410 negative-tone photoresist spin-coated on top of the ITO layers in order to maintain a constant distance between the electrodes. The nanostructured electrodes were aligned in parallel to set up an electrically switchable nematic liquid crystal cell. The optical and electrical properties of the LC cell were characterized.

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Figure 1: (a) Schematic setup of a LC cell. (b) SEM image of an ITO electrode with polymer spacers, nanostructured pixels and laser cuts. (c) SEM image with two spacers and six nanostructured pixels featuring sub-20 nm ripples at a period of 120 nm. Inset: magnified section.