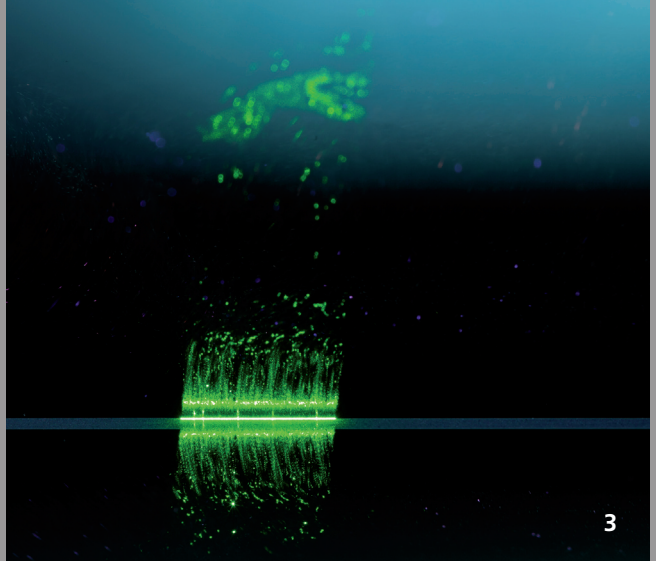

LASER ABLATION FOR PATTERNING OF THIN FUNCTIONAL FILMS

Task

Many novel products are based on conducting, semiconducting or isolating thin films. In most applications film thicknesses are needed in the range of nano- to micrometers. Their primary functions are of optical and electrical nature. A competitive process technology for patterning these films requires high process speed, small structure sizes and has to be applicable to large areas. High speed printing methods enable features down to 10 µm. The combination of these high speed processes with direct laser patterning offers high resolution at high throughput.

Method

Laser ablation has been proven as a versatile tool for thin film structuring. However, debris within and in the surrounding of the irradiated areas, thermal damage, as well as bulging all have to be avoided. Due to this, process development has to consider parameters like process atmosphere, wavelength, spatial and temporal pulse shape, and a cleaning step after laser ablation. In particular, patterning of transparent conducting Indium-Tin-Oxide (ITO) leads to bulging, which is problematic for adjacent coatings. The usage of ultrashort pulse lasers or excimer lasers with wavelengths in the deep UV enables physical processes that are not achievable with other technologies.

Result

Applying adjusted wavelengths, pulse durations and ablation strategies, patterning in the range of microns with negligible bulging is possible. Extremely high patterning speeds of several hundred meters per second can be reached with polygon scanners or by parallel patterning via multi beam splitting.

Applications

High resolution thin film patterning is of special interest for organic electronics. This technology can be used to pattern OLEDs, multi-functional RFID-tags and high resolution flexible displays. A different application is monolithic series interconnection of thin-film solar cells.

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3 Patterning thin metal layers with a ps laser.

4 Patterning amorphous silicon layers on glass.