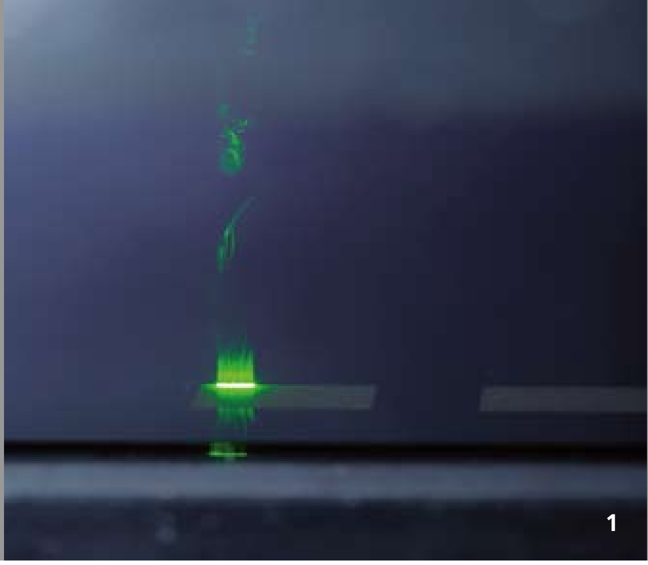

LASER PATTERNING OF THIN FUNCTIONAL LAYERS FOR ORGANIC ELECTRONICS

Task

Components in organic electronics, such as organic light emitting diodes (OLEDs) or organic solar cells (OPV) are built using thin layers of conductive, semi-conductive, insolating materials. Theses layers have thicknesses in the range from several nanometers to a few microns. They have to fulfill both electrical as well as optical functions. In order to generate a functional component, individual layers have to be patterned, made possible by using laser radiation at high resolution and selectivity along with simultaneously high process speeds.

Method

The transparent, electrically conductive indium-tin oxide is mostly used as the transparent electrodes of OLEDs. Lithography is normally used to structure this oxide. To reduce the use of acids and cleaning agents during the patterning process, as well as to increase the freedom of design, Fraunhofer ILT is developing patterning processes which use laser radiation. These new processes have to prevent material bulging and particles, since these can lead to short-circuits in the component part.

1 Patterning thin films on glass.

2 Laser radiation allows selective ablation of individual layers.

Result

Transparent, conductive layers can be patterned when wavelengths in the deep UV range or ultra-short laser pulses are used. In addition to conventional patterning by means of ablation, when radiation is used below the ablation threshold, conductive or semi-conductive layers can be modified in such a way that they subsequently become electrically insulating in the radiated zones. Since no material is ablated during modification below this threshold, material bulging and particles can be prevented. Due to the low power needed, extremely high structuring speeds can be attained on account of multi-parallel processing.

Applications

Thanks to its ability to ablate and, in particular, to modify, this high-resolution, minimal-damage patterning process is becoming more and more important for the production of organic electronics. Further applications of thin-film electronics, such as monolithic series circuitry of thin-film solar modules, can also profit from the processes developed here.

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