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MULTI-MATERIAL LAYERS FOR ELECTRONIC APPLICATIONS

Task

Modern electronic devices often consist of cheap but complex multi-material layers. Particularly on electrically conductive components, insulating layers are necessary to shield conductors or other functional layers from the substrate. Digital printing processes make it possible to apply these structured and flexibly designed functional layers in an inline process. Thanks to the laser-based thermal post-treatment of the layers, it is possible to functionalize these, i.e. to dry, to harden, to sinter or to crystallize them. Especially in the field of temperature-sensitive components and substrates, the local and short-term energy input by laser radiation can provide great benefits.

Method

As part of the BMBF-funded project »KombiFun«, Fraunhofer ILT has developed a laser method for drying and curing of sol-gel-based insulation coatings. The insulating layers are heated by laser radiation at a wavelength of 1064 nm and thereby dried and hardened. Other functional layers such as silver conductor tracks can be selectively applied with a printing process and functionalized by subsequent laser processing.

Result

In close cooperation with the varnish manufacturer FEW Chemicals, Fraunhofer ILT has developed optimized and electrically insulating varnishes for the laser process. These can be hardened in the shortest amount of time (< 1 s) by laser radiation, thereby achieving dielectric strengths of up to 1 kV. Conductive coatings of the coating materials can be prepared in the form of laser-sintered silver conductor tracks, which are based on nanoparticle inks. Here, conductivities of up to 50 percent of the bulk material can be achieved. These values meet the requirements of many products from the electronic mass market, such as sensors, signal cables or individual lighting.

Applications

The areas of application include insulated flexible and complex electronic components. Both metallic substrates as well as temperature-sensitive plastics or component assemblies can be used.

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1 Printed and laser-processed functional layers:
insulation layers with silver conductor
paths on metallic substrates and glass.