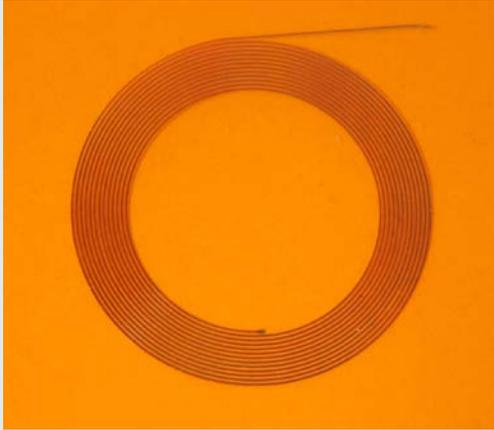


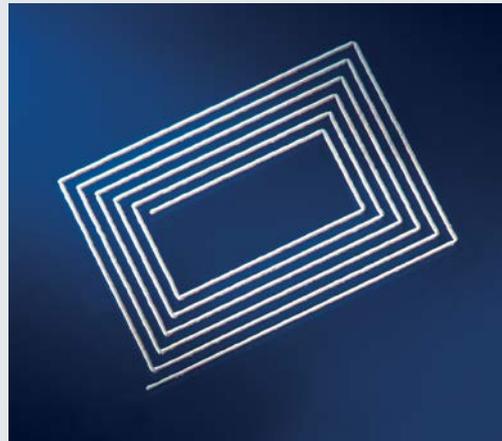
Inkjet Printing of Conductive Materials



Inkjet printing has not only become a versatile tool for graphical printing. Furthermore this technology is already in use for numerous applications of selective material deposition. Inkjet printing is a digital and contactless method. By means of this technology material is deposited in an additive manner without interaction of the print head with the substrate. New materials for printing electrical conductive structures are on the market. Details and experiences using these materials with microdrop print heads are reported here.

Materials

Several so called nano-inks are on the market. Those inks are mostly a mixture of volatile solvents and nano sized particles of metal such as gold, copper or the most common silver. The mechanism for establishing a reasonable conductivity is that after printing the solvents evaporate and a silver trace is left. The nano silver needs to be sintered at temperature above 150°C. Conductivities up to 10% of bulk silver are reached.



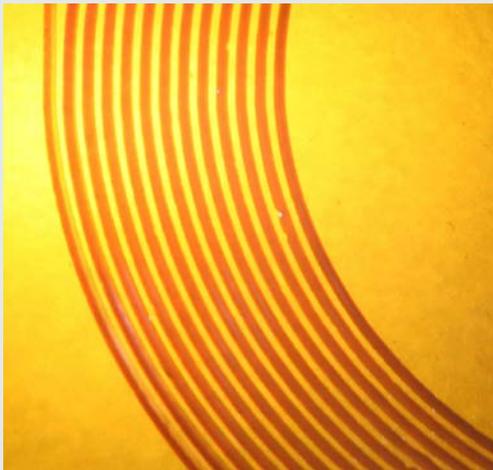
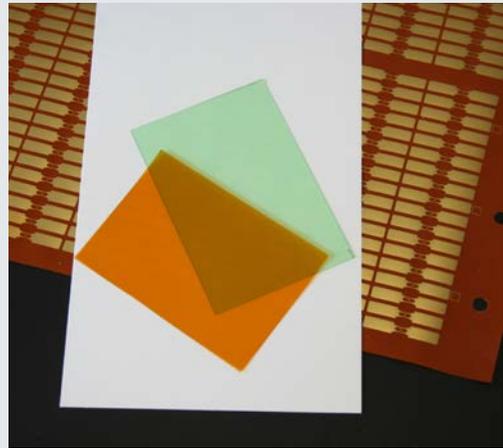
Technology

microdrop Technologies is specialised in developing instrumentation and processes for inkjet printing and microdispensing. For printing nano inks the microdispenser heads MD-K-130 and modifications with adapted nozzle design are used. For printing structures as lines, curves and complex combinations of these elements the heads are mounted onto the Auto-drop Professional System. The integrated software tool allows to print imported graphical files immediately.

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Substrates

Due to the principle of contactless dispensing the inkjet technology liquids can be deposited on any substrate. The behaviour of the droplet hitting the substrate is only dependent on the interaction between both materials. The wetting is mainly controlled by the contact angle between liquid and substrate material. For printing nanoinks we have experiences with the following substrates: Glass, paper, silicone, Kapton and others.



Process

The drop forming process is defined by viscosity and surface tension of the material. The behaviour of nano inks on a substrate is controlled by surface tension, viscosity, evaporation and material content. Typically a so called coffee stain effect with an inhomogeneous distribution of the silver particles over the surface is observed. The risk of displacement inherent to multinozzle bitmap printing is minimized by using a plotter-like printing algorithm with the print head following a continuous pattern. This aswell minimizes the risk of interrupted electrical connections.

Conductive adhesives

Beside nano inks also isotropic conductive adhesive (ICA) are in focus. Beyond good electrical conductivity also good mechanical bond strength is required. The material is based on an epoxy resin with a high content of silver particles; mean size: 2.4 μm . It was demonstrated that such materials are good printable with microdrop technology (EC project G1RD-CT-2002-00656). Structures down to 100 μm with a reasonable good conductivity are possible. Our proceeding investigations are focussed on achieving smaller structures.

