

Direct Metal Printing

Digitally printing of highly conductive patterns

Nowadays electronic circuitry of printed circuit boards, solar cells and other electronic applications are using a vast amount of chemicals. Moreover, the technologies used to manufacture these are far from flexible. Inkjet technology is rapidly evolving as a widespread accepted method for a digital and more flexible method for the manufacture of these products. Current inkjet technology, however, still produce low conductivity for the tracks printed, mostly with particle filled inks or an intermediary step by printing resist followed by a lithography process. Printing metal instead would produce highly conductive patterns with little or no chemicals involved. Apart from an environmental friendly solution also one that saves on production steps.

Rapid Manufacturing and inkjet technology

Rapid Manufacturing (RM) production creates products layer by layer, which makes it possible to manufacture customised products in small series without having to use expensive tools. TNO research focuses on developing new and improving existing RM processes.

Several RM processes already use inkjet technology to manufacture layered products. The knowledge available at TNO for inkjet technologies has made it possible to tackle the problem of direct printing of metal. Apart from printing in low-temperature applications like inkjet printing of solder alloy, TNO has also found solutions for inkjet printing of higher temperature alloys like copper and silver based alloys.

TNO's MetalPrint/GoldPrint

Able to inkjet metals with melting temperatures up to 1400 °C with 50 micron droplets, the technology is able to manufacture highly conductive tracks. The very promising method is able to print a wide variety of other high-melting materials that are not tested yet.

TNO's Pyrome Printer

Contrary to the metalprint/goldprint technology, where molten material is printed, the pyrome process uses an inkjet

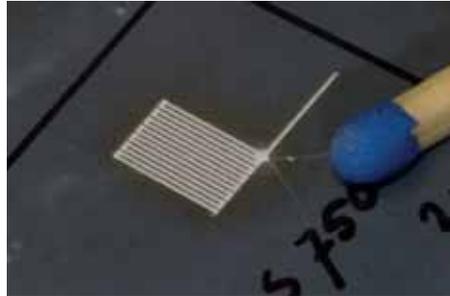


technology where a precursor is printed. After pyrolysis and melting of the metal a droplet is generated of approximately 5 micron. This may be used to prints highly conductive tracks with a very narrow width.

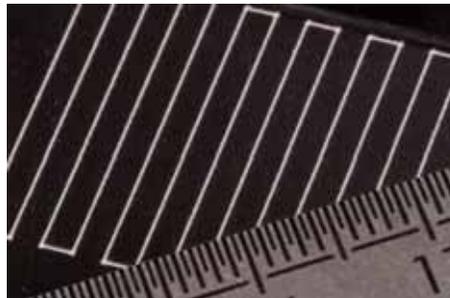
What does TNO have to offer?

We can offer companies added value in many ways through our contract research. The technologies can be adjusted to fit the customers' application and optimized for the customer to launch a new product. For printing highly conductive tracks, TNO has unique knowledge and patents:

- Printing of high-melting temperature alloys
- Printing of a wide variety of materials
- Printing tracks with very high conductivity
- Printing of very narrow width tracks
- Printing with drop-on-demand and continuous processes



The pyrome process on a silicium nitrite substrate



The pyrome process on a glass substrate

Rapid Manufacturing

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