

## Printed electronics: Screen printed strain gauges on the flexible substrates

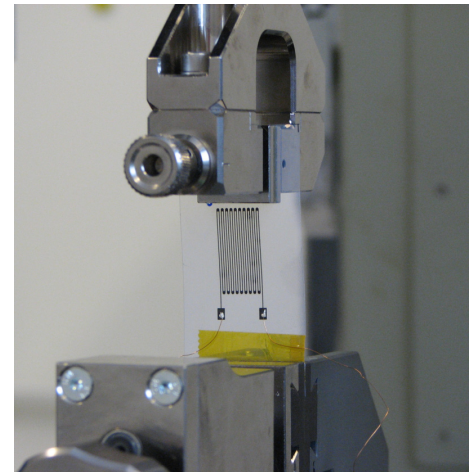
Strain gauges are one of the most useful and popular sensors in the technology and reliability testing. At Fraunhofer ISIT there are produced various accurate strain sensor types with different force sensing ranges and nearly linear signal response are being produced in low effort processes by using screen printing of carbon paste on the flexible PET substrate. The changes of the resistance by elongation are showed on the diagram. Sensor characterisation was done at the ISIT on our universal testing machine.

The strain gauges were manufactured by the methods of printed electronics. They were screen printed with the carbon paste and dried. The substrate is the transparent flexible foil (the thickness 130  $\mu\text{m}$ ) with a specially conditioned surface.

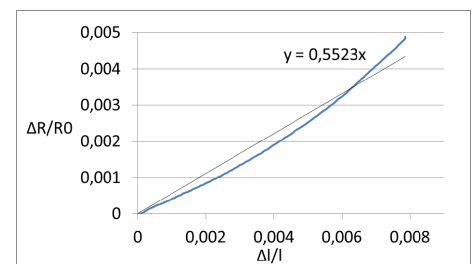
The sensor structure is about 10  $\mu\text{m}$  and consists of the standard meandric strain gauge structure where electrical resistance increases during parallel force application along the long lines. It has two contact pads, where the wires were glued with the conductive glue. They enable to connect the strain gauge to the measuring device or other parts of the system. Both the smallest space and the narrowest track are 150  $\mu\text{m}$  wide.

The whole production process was done at low temperatures not higher than 80°C. The changes in the resistance by elongation are repeatable and occur by increasing the force from 0 to 30-40 N. The gauge factor is about 0,55.

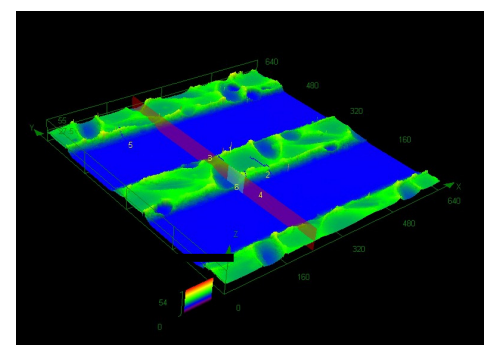
The product is an example of cheap and simple produced printed electronic sensor. It can be integrated in many systems, also in the applications where the flexibility and cost of devices are critical. Typical applications are wearable electronics and reliability testing in electronics.



Test stand for mechanical testing of the printed strain gauges.



Resistance-elongation measurement for determination of the gauge factor.



Optically measured profile of screen printed gauge carbon lines.

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