

Research Institute:

PTS Heidenau
Pirnaer Str. 37
01809 Heidenau

Head of the research institute:

Dr. Frank Miletzky

Project leader:

Sabine Pensold
Tel: 03529 / 551-610
Fax: 03529 / 551-889
E-Mail: sabine.pensold@ptspaper.de

Internet: www.ptspaper.de

Research area: Product aims

Paper, paperboard and board // technical speciality papers

Key words:

Printed electronics, electrical functionality, paper testing, print quality, durability, ageing

TITLE:**Influence of ageing processes on the mechanical surface properties of functional layers in printed electronics based on paper****Background/Problem area**

Flexible substrates like paper or film materials that are also suitable for roll-to-roll processing are becoming ever more important in the field of printed electronics. Compared to other substrate materials for printed electronics, paper is highly attractive in terms of price and raw material availability and thus in direct competition with plastic films. Disadvantages of paper like roughness, absorbency of the surface, dimensional stability and gas permeability are no longer an issue because they have been investigated and continue to be optimised by several research projects.

Many products in the field of printed electronics are designed for longer lifetimes (solar modules, various sensors, loud-speaker systems).

To analyse the long-term stability of these components, which depends on the stability of their individual functional layers, no standard simulation and evaluation system is currently available that is capable of describing the influences of stresses, loads and ageing processes on the mechanical surface strength and, thus performance of thin printed electronic layers in these systems.

Objectives/Research results

The aim of the project is to monitor and ensure the functionality of high-quality printed electronics on paper after their exposure to various factors of natural, artificial, physical and chemical ageing processes and loads.

It has been demonstrated, that papers designed for printing can serve as a basis for certain long lasting printed electronic products, if basic quality requirements are met. Specialised coating formulations have been developed in order to enhance surface characteristics. These coatings qualify the examined paper substrates for resistivity applications as e.g. realised in humidity sensors and beyond. Tolerable loads from mechanical, climate and irradiation stress have been determined to qualify the examined substrates for graduated applications of printed electronics.

In order to be able to forecast the performance of paper substrates in printed electronics applications, a number of test methods have been assessed. These include test of surface as well as bulk properties. It has been shown, that a good evaluation can be obtained by the combination of standard paper tests and more sophisticated test methods, such as optical topography measurement.

Application/Economic benefits

Forecasts predict enormous growth for products of printed electronics. Having been a niche market with a volume of just 1.9 billion dollars in 2010, their global market volume is expected to reach 55 billion dollars by 2020.

Printed electronics are intended to replace a wide range of conventional electronic components based on silicon or other materials. This provides the basis for cost-effective mass production. Analysts of IDTechEx are forecasting a steadily growing market for flexible and printed solar cells and sensors in coming years. In the field of sensor production, printing will even gradually supersede other manufacturing methods. This could mean enormous windfall profits for specialty paper producers, printers who are currently experiencing a period of recession due to declining jobs especially in gravure and off-set printing, but also manufacturers and converters of products based on printed electronics.

Period of time: 01 May 2013 – 30 October 2015**Remarks**

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