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Research area: General aims
Production economy // Monitoring and control systems

Key words:
Terahertz spectroscopy, thickness, grammage

TITLE:

Development of a online measuring system for thickness and grammage based on Terahertz-Technology

Background/Problem area

Grammage and thickness are the parameters most online measured at the production process of paper and cardboard. They affect the function of the paper product significant. The measurement is essential for an effective production. The amount of used material and energy for preparation and finishing is proportional to these parameters. They have a direct influence on the costs. State of the art is the measurement using radiation from isotopes. The use of radioactive isotope sources involves safety-related risks and conditions. It is subject to authorisation. The natural decay of the sources causes periodic costs. The limitation of the amount of source activity is also limiting the accuracy of measurement and the number of gauges in a production unit. The search for an alternative solution is ongoing for a long time.

The progress of terahertz-technology offers a possibility to develop a method based on electromagnetic radiation without isotopes. The Terahertz waves radiograph the material non-destructive. They are interacting with the material. It is possible to calculate grammage and thickness from this interaction. The progress of basic terahertz research enables compact fiber coupled sensors for an online measurement.

Objectives/Research results

The project objectives are development of an innovative measuring system, development of needed hardware and software components and integration in automation solutions. The measuring system will be able to replace systems with isotopes or x-ray.

Technical aim is the online measurement of paper parameters grammage and thickness.

- Measuring range for grammage: 20 g/m² … 2 kg/m²
- Accuracy of grammage ± 1 % (± 0,5 g/m² at grammage < 50 g/m²)
- Measuring range for thickness: 20 µm … 2 mm
- Accuracy of thickness ± 1 % (± 1 µm at thickness < 100µm)
- Measuring time < 100 ms.

The system will have a degree of protection of enclosure IP65. It will need the EMC requirements of industrial environments and shall cause no safety-related conditions.

The project is a collaboration of several partners from industry and research facilities. PTS is carrying out research in the field of algorithm and software development. Scientific aim is the development of mathematical methods for calculation of grammage and thickness based on physical relations and data based models (calibration). These methods must reference the special composite, structure and surface of paper materials.

Application/Economic benefits

The results of the project can be used in the field of applied engineering, production, measurement, monitoring and automation techniques.

The main focus is aimed at the production of paper and cardboard. It will be also possible to measure grammage and thickness of other materials like plastic foils, textiles and wood products. The project will create a new generation of measuring systems for paper and similar material on fast running production machines. Based on these results producers of automation systems can widen their product range.
The measuring system developed in this project should be of use for any producer of base materials and coated products. These producers are often small and medium sized companies can replace or complement their monitoring devices. The information from the measuring system will allow producers to control product quality and optimise costs for material and energy.

In a long term it is expected that common monitoring systems using radiation (isotopes or x-ray) will be replaced by terahertz systems.

Period of time: 01.01.2011 – 31.12.2012

Remarks

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