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Research area: Process aims

Process measuring and control technology

Key words:

THz spectroscopy, suspensions, emulsions

TITLE:**Characterisation of emulsions and suspensions by means of ATR-THz spectroscopy****Background/Problem area**

Many raw materials and media in the paper production, but also in other industrial sectors, are dispersions of liquids and solids, thereby emulsions or suspensions. These mixtures, which usually appear macroscopically homogeneous, consist of often completely immiscible fractions, whereby critical and user-relevant properties arise of the interaction of a number of parameters, ranging from the charge distribution and ion mobility up to the particle size distribution. In addition to the dry content or material density usually sum parameters are collected and used for production monitoring.

The measurement of density or dry matter of various dispersions seems to be an easy task in the industrial practice, but has not yet been solved for fibre suspensions of the paper industry. Common are microwave methods as well as techniques that mechanically determine the required values. Therefore a substance-specific adaptation of the measurement technique is required in both cases.

The attenuated total reflection (ATR) spectroscopy is a niche terahertz measurement technique with a clearly defined field of application: it is suitable for highly absorbent and liquid samples.

Objectives/Research results

The aim of the project is to determine the composition of suspensions and emulsions using ATR-THz spectroscopy and to detect deviations from a desired value. The test setup should already be designed for a possible application as an inline measurement method. The goal for the field of paper making is, to shed light on the core parameters beginning with density and ash, and to evaluate the possibilities for detecting secondary components (stickies, starch, additives), which have significant effects on processes and production even in small quantities.

Technical results

- Setup of a terahertz spectrometer ATR
- Results on the suitability of fibre-coupled components in the THz-ATR spectroscopy
- Development of an algorithm for data analysis of the THz-ATR measurements
- Quantification of the attainable accuracy of the data analysis
- Statements about the robustness of the THz ATR measurements related to environmental conditions

Scientific results

- Creation of a simplified physical model of suspensions
- Derivation of the interaction between the suspension and the THz radiation within these models
- Database of terahertz spectra for suspensions of different composition and
- Combination of measurement results with the composition of the suspensions

Application/Economic benefits

The research results are especially useful in the fields of process technology, production, measuring, monitoring and automation, as well as in the industries of paper production and processing and food production, as well as in other areas where emulsions and dispersions represent raw materials in the production.

Economic benefits will be

- Ensuring a uniform and good production
- Improving the knowledge of the production process
- Prevention, reduction and faster recognition of rejects by early measurements in the suspension
- Selective detection of production disruptions and fluctuations

Period of time: 01.04.2013 – 31.03.2015

Remarks

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