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Research area: General aims

Production economy // Monitoring and control systems

Key words:

NIR spectroscopy, offset printing, mottling

Title:**Evaluation of paper coating variations and print mottling by NIR spectroscopy****Background/Problem**

Offset printing is a very complex printing process, both chemically and physically. On the other hand, it provides great flexibility for printing and has only relatively low printing plate costs. Therefore, it is the most widely used printing process worldwide, as sheet fed offset printing or as web offset printing. But defects in the uniformity of print results can occur especially in offset printing. These defects are called "mottling" and can be due to the parameters of the printing process or due to the properties of print substrates. They are the most frequent and cost intensive causes of customer complaints. Mottling defects have diameters of about 0.05 to 3 mm and show as spots and speckles in the print image.

The most important reasons for mottling are variations in coating thickness and a poor binder distribution in the coating layer, respectively. Other reasons can be differences in the pore structure and local roughness of the paper surface which **are caused by** ash distribution and formation, for example.

Mottling defects can be examined in different ways. Today quality control mainly consists of test prints followed by visual inspection of the print image. The result is an empirical mottling number. The test prints can also be investigated by a special image analysis system which gives an index value for the printability. These methods give only information on the coating characteristics of a relative large area. Until now there has been no practicable method which permits quantitative evaluations of the distribution of coating pigments and binders within the diameter range of mottling defects.

Research objective/Research results

Developing a fast procedure for the evaluation of non-printed coating papers is the aim of this project. The following intermediate results have been achieved:

- Measurement with the NIR microscope requires a longer measuring time. It is therefore necessary to optimize the surface for NIR measuring.
- The integration time must be 32 scans for one correct spectrum (comparison: 16 scans are sufficient for standard tasks)
- The first measuring area scanned with the NIR microscope was 240 µm x 240 µm. The resolution was 10 µm. But to get more information in the same time, the measuring distance must be larger. The resolution of 100 µm is sufficient.
- More than 190 samples with known amounts of coating ingredients were measured with NIR-equipment and - after the test prints - also with the DOMAS image analysis system.
- 200 spectra were obtained for each sample. These were evaluated with different quantitative NIR models to determine the concentrations of coating binders or pigments.
- The surface quality of the coating papers was described by means of these quantitative NIR results. They were the starting point for a new computation - the topographic characteristics.
- It is possible to get a good correlation between some of the topographic properties and the mottling index, but this has been accomplished only for a few samples so far.

In the further parts of the project this procedure will be applied to all measured samples.

Application/Economic benefits

The research results are of interest to manufacturers of coated printing paper, especially to manufacturers of offset printing paper. Today about 30 % of the paper production in Germany are coated papers with an annual growth potential of 3 to 6 %. In May 2004 the prices for coated printing paper were between 680 €/t and 710 €/t (rolls) and 840 €/t and 890 €/t (sheets). A further price rise is expected.

In general the time between production and print lies in the range of one week to several months. The value of the paper produced by one paper machine is several million € during this period. So, for the paper manufacturer it is very important to continually control the quality of paper, in this case the mottling tendency, to detect and to correct negative changes in the production process without much delay. Therefore, the proposed measuring method by NIR microscopy can contribute to cutting production costs. Additionally, it gives important information for the improvement of product quality.

An improved and cost saving measuring method for the mottling tendency of coated paper is also beneficial to printing companies (about 1,300 in Germany) which can expect a better and more stable quality of their printing paper. The bigger companies could even use the measuring method for evaluating the paper quality by themselves.

Project period: 1.2.2006 - 31.1.2008**Remarks**

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