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**Research area:**

Process aims / Process measuring and control technology

**Key words:**

Print Phenomena, Offset, Ghosting, Mottling

**Title: Relevant properties of offset printing papers for best printability as well as appropriate measuring techniques****Background/Problem area**

Within the "PAPRIQUA" (Paper Properties for Print Quality) project researchers from five European countries – Germany, The Netherlands, Spain, Belgium and Slovenia – combine their experiences and capabilities to achieve a better understanding of two still unsolved specific offset printing phenomena; mottling and ghosting. The term mottling describes the phenomenon of a non-uniform appearance of a solid tone or halftone area in the print image and is one of the most important quality problems of printed products, especially of those printed on coated paper grades. There are several different types of mottling, the most frequent of which are called backtrap mottle and water interference mottle. All types of print mottle are influenced by numerous factors and can be traced back to different causes. In some cases, however, the contributing factors interact with each other.

The ghosting effect in web offset printing is a print defect that occurs when a printed image on the reverse surface appears on the top printed surface in the form of lighter structures ("ghost images"). The name "ghosting" emphasizes the fact that this phenomenon occurs in a random way both with respect to time and location on the printed sheet and therefore leaves it largely unpredictable. There is no statistically significant information about the causes of ghosting in web offset. When experts are asked about the potential causes of ghosting, they name virtually all parameters involved in the printing process as possible contributing factors.

**Objectives/Research results**

Aiming for a better understanding of the mechanisms leading to mottling and ghosting one of the main means within the project was the collection and evaluation of data obtained in the targeted industrial printing trials. These investigations were accompanied by conventional paper testing methods to describe the product properties as well as by the application of potentially powerful measuring techniques (i.e. topography, cross section, spectroscopy analysis and the study of wetting, sorption and penetration behaviour). The occurring print phenomena were characterised both visual and metrological. For the latter, standardised densitometers or scanners with accompanying image analyses are utilized. As for mottling, relevant tools already exist to quantify the unevenness but they still need to be developed for ghosting. Therefore, a range of corresponding algorithms are being designed and implemented to the DOMAS system. Obtained parameters, especially the circle equivalent diameter (CED) has shown itself to be suitable to evaluate the dot size changes, due to ghosting effect. Brightened areas occur due to the decrease in the size of the printed dots. This fact confirms that ghosting is not related to problems such as print through or shine through. Ghosting is caused by different ink coverage on opposite sides of the paper web, which depends on the printed motif. However, this phenomenon doesn't always appear, or it disappears and appears again during the process. Moreover, it is clear that some papers show the ghosting effect at the earlier and some at the later point of time. Ghosting is however not a monocausal problem, it is rather caused and influenced by a complex interaction of a high number of parameters and complex relations during the ink transfer. However, depending on the paper properties the ghosting effect can be more or less pronounced. The investigations showed that low bending stiffness or low surface roughness and porosity come along with a higher potential for the ghosting effect.

Mottling in sheet fed offset printing was assessed by a specially developed printing form, which reflects possible printing conditions. However it simulates also combinations that are not to be found in practice but that are necessary in order to separate the different mottling phenomena. Only the field on the printing form at which a single ink is transferred onto the paper without any further contact, can be directly related to the paper properties. Therefore, this mottling type (single colour mottling) will be termed as a "basic level mottling" This basic level can increase or decrease depending on the further printing conditions. Water interference mottling bears a paper component, however superimposed with other parameters. This effect depends on the printing unit in which the ink was printed and the number of printing units before and after this unit. In other words, the amount of water brought onto the paper before the ink, but also the number of printing units that follow after it and provide a sort of equalization of the printed film are influencing the strength of the mottling effect.

**Application/Economic benefits**

The project shall provide a significant step forward in avoiding the researched printing interferences by understanding and spotting their appearance early enough to take appropriate counter measures in due time. Examples might be the adaption of the print form design to the paper which should be used, or the selection of a paper grade that tends less to develop the mentioned print effects. Additionally, the project results are intended to promote the introduction of appropriate modern measuring techniques in the paper and printing industry.

**Project period: 01.07.2008 – 30.06.2010**

**Remarks**

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