Subject:
Improving the formation and printability of SC papers by optimising the interactions between retention, flocculation and drainage

Background/Problem area
Because of their good printability characteristics and economic advantages, SC papers are increasingly used in gravure printing to produce high quality printed papers. SC papers are uncoated papers whose surface smoothness does not result from coating but from the pressure and elevated temperatures applied in a calender. This method requires a high smoothness of the base paper, which is directly related to the formation process of the latter. The high speeds of modern paper machines result in increasing requirements to the draining of stock suspensions and retention of fines and fillers. Effective improvements in drainage and retention frequently result in higher costs and worse formation. Dual retention systems promise to solve this problem by a special mechanism: The primary flock is being destroyed by shear forces and rebuilt in a secondary flocculation process. This finer flock shall ensure high retention and good drainage combined with good formation. Previous studies were conducted under predefined conditions on a laboratory scale or in pilot paper machines. There are no systematic studies of production units regarding the interactions with other additives and the process water.

Objectives/Research results
The project aims at improving the printability of SC papers by optimising the formation in combination with good retention and drainage on the basis of advanced knowledge of the mechanisms and interactions of dual retention systems. Within the framework of this research project concepts and detailed instructions are to be elaborated for improving the sheet formation in SC paper machines without productivity losses (retention, drainage).

The first step is a systematic investigation of three SC paper machines. Besides the determination of system and quality parameters, identifying the correlation between the online measurements of flock size and formation is a key task of this step.

The second step includes laboratory experiments with variations of process conditions by means of a "Dynamic Filtration System" (DFS). Additive influences on the retention system and variations of the system will be investigated under practical conditions to develop new formulations. The optimised formulations will be used to form hand sheets for the evaluation of formation results.

In step three the knowledge of steps one and two will be combined to derive an optimisation strategy to be implemented in a pilot paper machine. The papers produced will be calendered under near-practical conditions by a pilot calender, and their printability will be evaluated.

The last step is the transfer of the strategies developed to one of the SC paper machines studied in step one. Initial results suggest a significant influence of the sheet former design on the formation of SC papers, whereas the retention system (additive dosing) has comparatively little influence. This is because the re-flocculation occurring in low-speed paper machines is counteracted and reduced by the very high shear energy input in the sheet former. The formation process of these formers is therefore strongly determined by the design and adjustment of the dewatering elements. The expected advantages of dual systems (use of two mutually adjusted additives to achieve the desired retention effect) were confirmed by the tests. Dual systems have positive effects on retention and formation, but cause slight reductions in production capacity. An even stronger relationship between retention aid dosing and formation could be shown for the manufacturing of printing papers on fourdrinier wires. Machine-technological parameters must therefore be regarded as important formation influences which cannot be ignored in optimisations as aimed for by this project. A description of the formation process by means of mathematical models is envisaged as well.

Application/Economic benefits
An optimisation of the counteracting parameters formation and retention based on the efficient application and selection of retention systems increases the economic efficiency of paper manufacture. Not only does optimised drainage increase the machine productivity, it improves the paper quality through finer formation as well. The good printability of graphic papers resulting from high smoothness and good formation is one of the most important quality characteristics of this paper grade. A reduction in chemical costs is achieved as well by the optimisation of retention systems.

Project period: 01 July 2003 – 31 December 2005

Remarks
The research project AiF 13670 is sponsored by the German Federal Ministry of Economics and Labour.
Are you interested? Then send us this short description with your name and address via fax. The project manager will contact you afterwards.

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