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Research area: Process aims
Paper and paperboard production // Surface treatment

Key words:
Co-binder, self-levelling, metering blade, scratches

TITLE:

Developing concepts for co-binder systems regarding the enhancement of the self-levelling properties of paper coating colours with the aim of reducing the intensity of application-induced damage to the coating

Background/Problem area

The paper coating process nowadays normally involves contact application. After application of the coating colour, the coating is levelled through contact with a blade which has the advantage of creating well levelled surfaces suitable for printing. However, a problem associated with such blade metering systems are defects in the coating which can occur either through solid pollutants/impurities in the coating colour, rheology problems of the coating colour or defects in the blade. The scratches/grooves produced present a problem, especially in high-quality sheet fed offset printing.

Several co-binders, especially casein and crosslinked poly(vinyl alcohol) are known to be self-levelling in various applications. It may be possible e.g. for casein, due to its complex supramolecular structure, to link self-levelling phenomena to self organisation. Such special behaviour is also known from self-levelling cementitious floor screeds which contain casein as the plasticizer. This kind of self-levelling behaviour might also work to some extent for paper coating colours.

Objectives/Research results

The goal of this project is to develop concepts for co-binder systems aimed at enhancing the self-levelling properties of paper coating colours to thus avoid defects caused by the application process (metering blade or rod). Therefore, classic systems known to provide a smooth surface will be investigated regarding their levelling mechanism. The ensuing knowledge will then be transferred to new co-binder systems obtained from renewable resources such as modified starches for example in order to find and develop sustainable co-binders for the above-described goal.

Up to the middle of the last century, casein used to be one of the main binders for paper coatings. Since then, synthetic polymers have completely taken over due to the manifold possibilities of property design and low costs. However, casein was always well-known for achieving nicely levelled, smooth coatings. In order to regain these properties and as a starting point for this project, an offset paper coating colour was prepared containing 50% casein as the binder. It was compared to the standard without casein. An appropriate amount of synthetic thickener was added to produce comparable rheological properties. The microscopic images reveal that the grooves which were applied on purpose are much less pronounced in the formulation containing the casein.

Levelling is dependent on the one hand on the amount and type of co-binder and on the other hand on coating colour rheology. Water retention was found to have a minor effect on the self-levelling properties of the coating.

This knowledge will then be transferred to other renewable resource materials such as starches or other polysaccharides. In addition, the mechanical treatment of the paper web which might also lead to better levelling was investigated, although it did not reveal any improved levelling behaviour of the coating colour. Finally, the overall most promising new self-levelling coating colours will be tested on a pilot scale. Industrial-scale printing trials will ultimately determine the quality of the finished coated paper products.

Application/Economic benefits

The results of this project are mainly of interest to the industrial sectors of paper, publishing and printing. Furthermore, branches of the chemical and agricultural industries (additives, starches) as well as mechanical engineering may also profit from this research project.

Application benefits include better levelled coatings and in some cases a potential reduction in calendering. Economically speaking, moving away form fossil oil based products is an important objective of this project, since it results in the generation of new markets for renewable resource materials (e.g. starch or other polysaccharides).

More specifically, prevention of scratches/grooves in the coated paper has advantages for the printer, because less discard is produced as the number of defective sheets diminishes. This project also gives smaller enterprises who are suppliers of additives or chemicals in the area of co-binders/rheology admixtures a cost-efficient basis on which to develop new special products that cannot be produced economically on a large industrial scale. Manufacturers of special vibration machines as well as machine manufacturers may acquire new business fields by successfully working out the mechanical treatment of the paper web in this project.

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Remarks

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