Continuous Coloration of Coatings for Coated Paper & Board

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ABSTRACT

One of the very important aspects of making coated paper and paperboard is still being done in a primitive manner, and that is the addition of colorants which give the end product much of its visual (and overall) appeal. The dyes and optical brightening agents are added to the coating in a batch-wise manner, often through the use of manual measurement from a drum or tote into a container, which is then poured into the coating makedown tank by hand. This leads to issues of accuracy, repeatability, manpower utilization, and safety. There is a better way, and the model for the alternative comes from the addition of colorants to uncoated freesheet (and other types of uncoated papers). Pilot work has proven that dyestuffs can be added continuously to coatings just prior to the coating's application to paper or paperboard with excellent results.

INTRODUCTION

Coatings have been applied to paper and paperboard for decades for the purpose of enhancing printability and imparting other important end properties to these paper products. Yet, the process of making the coatings has remained largely unchanged (aside from limited automation) over this same period.

In the manufacture of coated papers (e.g. LWC) and coated board, the coatings themselves are mostly made in a batch process. The dyestuffs and optical brightening agents (OBAs) are added to these batch recipes along with all of the other components.

DISCUSSION AND RESULTS

Shade and appearance of coated paper and board are VERY important aspects in their fitness for use and acceptance. "Marketing psychologists state that a lasting impression is made within ninety seconds and that color accounts for 60% of the acceptance or rejection of an object, person, place, or circumstance. Because color impressions are both quick and long lasting, decisions about color are critical factors in the success of any visual experience." [1]

Color is the combination of three components: Light Source, Object, and Observer (Eye-Brain). If any of these three changes, then the shade and appearance can change as well. [2] In our case, we are trying to keep the object consistent so that it, the paper or paperboard does not change in shade, brightness, CIE whiteness, etc. How can this be done better than it's being managed today?

Well, what would happen if the coater on a paper machine or off-machine coater (OMC) were treated like some size presses on paper machines and add dyes and OBAs were added continuously? Finally! We'd have the ability to adjust shade throughout a reel right at the coater and in real time. Shade adjustment would no longer have to be done batch-wise. Shade control could be done continuously, fine-tuning the finished appearance of the product. This is analogous to the transition from pulper dyeing to continuous dyeing on an uncoated paper machine. And, when an off-machine coater is used, there would be the possibility to correct shade via adjustments in the coating's dyestuffs versus downgrading or broking the product. Also, the "heels" of coating batches would not need to be dumped when it was time for a shade change only.

What other advantages would accrue to having continuous dye and OBA addition to the coatings? Well, shade development could be done much more quickly for new grades, and there would be no need to accept "as close as we can afford to get for now." It is possible that 2-sidedness in shade and fluorescence could be minimized or eliminated – without altering the amount of coating applied to one side of the sheet versus the other. Imagine, too,

no more “ruined” batches of coating due to the addition of too much dye or OBA. There would be no need to “doctor” batches of coating, either.

How would it be accomplished? Dye and OBA would be added to the coating delivery line, close to the coating head. Adequate mixing would be required to distribute the dyestuffs homogeneously throughout the coating. It would also be necessary to have good color, fluorescence, and brightness measurement of the coated paper. Ideally, this measurement would be available for both sides of the sheet. Closed-loop color and brightness control are also highly recommended.

Getting specific, dye and OBA should be added as close as possible to the coating head while still achieving good mixing. Two process elements which provide good mixing are the Moyno coating delivery pump and the coating screens. If there were a requirement for additional mixing, an in-line mixer could be installed, but this is not likely to be necessary.

Simulation work done in the R&D center of a large paper company by an individual with strong skills in fluid dynamics predicted very positive mixing results. Pilot machine work proved out these predictions with excellent mixing of above average dosages of dyestuffs to coating.

What else did the pilot coater work show? Well, in two separate trials that were conducted, the colorants were added to the coating directly in front of the coating delivery pump. In the first trial, a combination of aqua-colored tinting dye and an OBA were used. When evaluated in a light booth and looked at under “black light” it was obvious that coverage of the dye and OBA respectively were very good. In the second trial, a violet-shaded pigment was applied much more “deeply” than would be seen in white papers. This trial also demonstrated thorough coverage of the sheet. NOTE: In both trials, no dye had been added to the basesheet (pre-made without dye).

CONCLUSIONS

Traditionally, coated paper and paperboard mills have tinted the coating of white papers in the coating batch-wise. There are several disadvantages to this batch-wise approach, including the long delay between coating makedown (or shade adjustment) and its delivery to the coating head. During this lag time, no shade adjustment can be made to get or stay on shade. Coating at the end of a grade run which is only “off” for shade must be dumped in order to make way for new coating made to the proper shade and fluorescence. Advantages on the flipside (continuous dye and OBA addition) include elimination of shade 2-sidedness, no more doctoring of coating batches, and full coating batches would not be ruined by the accidental overdosing of dyes and OBAs. Also, rapid prototyping of new products for coating shade can be achieved since the dyes can be adjusted continuously until the desired shade is achieved. The finished product can be optimized, not compromised, for shade and appearance.

References

1. www.COLORCOM.com, an Internet Website. COLORCOM is a registered trademark of J.L. Morton

2. Billmeyer, Fred W. and Saltzman, Max, Principles of Color Technology 3rd Edition (2000)