



HOW DRYER SECTION INFLUENCES THE FINAL PAPER QUALITY

In the Dryer Section of a paper machine, after dewatering in Forming and Press sections, most of the remaining water is evaporated and strong fibre binding developed as the paper contacts a series of steam heated cylinder in the drying section. Water removal to the final moisture level of 4% to 9% is a critical step and majority of functional properties of paper are developed in this section.

Importance of Dryer Section - the economics is very clear

Dryer section of a paper machine removes between 1.1 and 1.3 Kg of water per Kg of paper compared to 200 Kg and 2.6 Kg in forming and press sections respectively. (Reese,1988) The relative costs of dewatering are forming section 10%, press section 12% and dryer section 78%.The Dryer section constituting approximately 60% of total length of paper machine, uses the maximum amount of thermal energy in a paper machine and accounts for 40% of the total capital cost of the machine.

What are the various influencers on Paper Quality?

As the wet paper web comes to the dryer section, having passed through the forming and the press section, almost all water gets removed by then. During drying the paper shrinks in the direction of thickness and in its plane. The paper web is strained in the machine direction and shrinkage happens in the cross direction. In such condition the edges of the web shrink more than the middle of the web. This results in variation in paper properties in the cross direction. Drying under restraint gives higher modulus of elasticity, higher tensile strength and better dimensional stability. Difference in drying stresses and fibre orientation result in difference in paper properties.

Wire marking on paper is a quality issue particularly for cigarette paper and special fine grades. Three types of marking are possible - mechanical marking, evaporation marking and marking due to uneven support. The evaporation marking is usually the uneven drying due to permeability differences in fabric or seam area and web contact.

The drying process can impact two important quality parameters - paper curl and cockle. The main reason of curl is the difference in fibre orientation through the thickness of a paper. Stresses further add to the curl problem. On the other hand, a sheet with uniform structure through its thickness will curl if dried non-uniformly. Non-uniform drying can be a result of a temperature difference between

top and bottom dryer cylinders. Cockle is a localized defect due to shrinkage and deformation of fibres while drying. Cockle can be worsened by sheet sticking to dryer surface, high wet end dryer surface temperature and too rapid drying.

Critical CD Profile for end – user

Two critical profile in the cross direction influencing the functional property of paper for end user are - moisture and shrinkage.

The moisture profile at dryer output depends upon the moisture profile entering the dryer and uniform vapourization during drying. Entering profile is derived from basis weight profile and fibre orientation. Variations in surface temperatures of dryer cylinders, variation in heat transfer caused by dirt accumulation at heat transfer interface or uneven contacts, pocket ventilation profiles, felt permeability profiles - all can cause resultant moisture profile.

In a practical system, CD shrinkage is uneven during drying process and during free draw between last press and first dryer cylinder where there is a stretching phenomenon. It can further worsened in the dryer section. By measuring and analyzing the CD shrinkage across the web, papermakers can establish proper actions connected to adjustments in machine and/or process settings in order to influence lateral paper contraction and decrease its variation level, as well as improving different CD paper properties such as dimensional stability.

Thus, poor profiles can cause problems with sheet release, increase break sensitivity and increase steam consumption. On line instruments available from many top machinery and instrument suppliers can accurately measure and map 2 sigma CD moisture profile to help the papermakers proactively.

Challenges faced in today's faster machines -

As machine speeds increase, the technological demand to maintain existing levels of CD variations has increased and so has the demand to improve the level of variation beyond that of existing levels. In the area of CD weight, controllability of zone widths down to 35-mm or 25 mm has become a need which is now addressed.

Solutions used to improve the CD moisture profile :

Moisturizing Sprays - Instead of adding extra energy, fine sprays of water are used at localized areas with 'dry' spots. This solution has

INDUSTRY NEWS The 700 year-old legacy of fine handmade paper from Kagzipura has caught the attention of revivalists.. W&F provides specific customer need based solution in Forming fabric with AQUAPRINT brand for customer quality need.. W&F takes necessary fumigation and safety measures in packing of fabric and screens before movement, this ensures safety at consumption end.

lower energy efficiency but has advantages of - helping better calendaring in machines with calendar and also help in controlling the curl

Steam Boxes - Steam shower is used on foudrinier and press section, resulting in condensation in web and resultant increase in temperature which in turn reduces the viscosity and surface tension of water. This makes water drainage easy at couch roll and in the press.

Infrared profiling systems - Modular infrared generating units are placed side by side along the width of the paper machine can effectively flatten a moisture profile. This equipment can be gas fired or electrical (faster response). The modern infrared dryers are engineered specifically to provide moisture profile control with high resolution and deep penetrating power, to control not only the CD profile but also the 'Z' direction.

Pocket ventilation and Dryer Spoiler bars - In all modern machines, these are integral part of the machine configuration. Still some extra profiler is also incorporated to further optimize the system to meet demands of paper.

What is the level of control desired?



It is a common expectation that CD profiles should achieve a 2-sigma variation level of 0.5-1% of process. That is, 2-sigma/Average weight x 100% = 0.5-1%. This general specification is achievable on most paper grades.

Cleaning Of Dryer Fabrics

Practically, the dryer section would have contamination like stickies, pitch, sizing and paper dust depending upon the quality and furnish. There are modern solutions available to address this through special cleaning chemicals program or composite supercleaning devices. These cleaning chemicals could be water based solvent blend with wetting & dispersing agents with high flash points >200 degC. They are highly alkaline with less than 1% free caustic. Similarly there are online dryer cleaning systems available which are water free and therefore do not require any high pressure pumps, high pressure water filters and high pressure water nozzles..

CONCLUSION

Paper Drying is a combination of heat and mass transfer. While the heat is mainly transferred by conduction and to a lesser amount by convection, the mass is transferred by evaporation and diffusion of water vapour. The drying section consumes almost 65% of the total energy usage in the paper mill and hence for sustainability, it is absolutely important to know where the “money” is and have a periodic health-check / audit of the dryer section. Detailed analysis of main components involving the dryer section by using data from field measurements is vital in identifying root cause(s) of poor dry end efficiency and for driving improvements. Tuning of steam and condensate, pocket air ventilation systems and hood balance are important for dryer section efficiency. Over-all, mills are reviewing their CD moisture profiles, and have decided that narrower CD moisture profile control is needed to meet their customers' expectations for paper quality and downstream conversion processes, while at the same time recognizing that uniform moisture profiles and shrinkage profile make their machines easier to run.

QUOTABLE QUOTE	Keep your face always toward the sunshine—and shadows will fall behind you.” —Walt Whitman
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WINNER APR. 2023	Quiz: Which is the part where lignin is highly concentrated? (a) Outskirts of lamella (b) Middle lamella (c) Mitochondria (d) Pith Mr. Babu Kambadkone, M/s Gayatri Paper Mills, South Africa Answer : (b) Middle lamella
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