

AN IN-DEPTH LOOK AT REVERSE ROLL COATING

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EXTENDED ABSTRACT

This is a presentation that examines the reverse roll coating process beyond its mechanical features. It will address the basic operating features of a three-roll, nip fed coater; the effect that roll speed and gap has on coating quantity and quality; a look at what happens to different coatings when they are in the gap between the metering and applicator rolls; and discuss some of the ways to overcome coating defects that develop. It concludes with comments that address the question “is it the coater or coating”?

The reverse roll coater is among the most versatile, since it allows more than one operating condition to be varied, namely roll speeds and gap. For a given gap, the ratio of the metering roll speed to applicator roll speed will affect coating thickness (quantity), to a point. If the ratio is increased, the thickness will be reduced due to the reverse wiping action of the process. The coating thickness will continue to diminish until the rheological properties of the coating causes an increase in thickness. At that time, any further reduction in thickness will require a gap change.

The coating quality is also a function of the metering roll/applicator roll ratio. If that ratio is low, a “ribbing” defect might occur. It is usually caused by instability of the coating at a particular process condition and appears gradually as a continuous circumferential pattern whose frequency and pitch is related to the capillary number and surface tension values of the coating. In most instances, the roll speed ratio can be increased to overcome the defect. Conversely, if the metering roll/applicator roll ratio is too high, it may cause a “cascading (sea shoring)” defect. This is primarily the result of the coating wetting line moving to the upstream side of the roll gap, which causes air to be entrained in the gap resulting in surging of the coating and uncontrollable coat weight. This effect comes on

quickly and appears as a series of cross-machine direction wavy lines. It can usually be prevented by decreasing the roll speed ratio.

If a uniform, defect-free coating can not be achieved by roll speed or gap change, it may require changing the properties of the coating. Each coating material has particular physical and rheological properties, usually defined by its capillary number, viscosity and surface tension. By examining these properties, one can establish a plot that shows the coating window(s) that defines the areas in which the coating is stable and where defects might occur.

In the long run, one must assess whether the coating problems lie with the equipment or with the coating. Assuming that it is due to the equipment, change one variable at a time and see if the problem persists. Once you have gone through the different settings with no marked improvement, it is time to look at changing the coating.

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