

An Experimental Investigation of the On-set of Ribbing in Forward-mode Deformable Roll Coating

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Abstract

Utilised extensively by industry, deformable roll coating involves the use of elastomer-covered rollers to deposit extremely thin liquid films, of a desired quality, onto substrate such as paper, plastic or metal foil. A common problem when operated in forward-mode (both rolls counter rotating) is the on-set of ribbing and the production of a non-uniform coating; instead of forming a smooth uniform film, its thickness varies in a wavy sinusoidal manner in a span-wise direction. This has a direct impact on the final coated product, in terms of poor appearance and a reduction in the functional properties of the coating.

This paper addresses the formation of ribbed films in both the positive and industrially relevant negative gap (where the distance between roll centres is less than the sum of the roll radii) mode of operation. A careful and systematic experimental study is used to reveal the dependence of the critical capillary number and wavelength of the ribbed film on the operating conditions of the coating head (roll speed and gap setting) and elastomer covering (viscoelastic effects and layer thickness). In particular it highlights how the operating parameters can be manipulated/varied to delay the on-set, or reduce the impact, of ribbing in terms of the coated film thickness.