COATING OF PHOTOSENSITIVE CYLINDERS

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Photosensitive cylinders are used in printing arts and more particularly in electrophotographic printing (xerographic copy). The photosensitive coating is applied to the cylinder in liquid form, before it is solidified. The liquid is applied to the roll through a needle applicator that translates along the direction of the cylinder axis. The cylinder rotates during this process such that the liquid is applied in a spiral pattern. To help spread liquid over the cylinder surface and improve the thickness uniformity, each liquid stream applied from the needle passes under a flexible blade.

As two consecutive passes of the spiral pattern meet in the cylinder surface, a film thickness non uniformity can be observed, which may compromise the performance of the product. The complete fundamental understanding of the flow is vital to the optimization of the process.
The flow is analyzed theoretically with the goal of determining the operating conditions that minimize the variation of the film thickness. The theoretical model is based on the lubrication approximation considering a thin precursor film ahead of the apparent contact line to overcome the stress singularity. The resulting non-linear fourth-order PDE for the film thickness was solved by a second-order finite difference method. Time integration followed an implicit Crank-Nicholson scheme. The resulting non-linear algebraic equation at each time step was solved by Newton's method.

The results show the evolution of the film thickness deposited on the cylinder surface as the feed port moves axially along it and the leveling of the deposited film at the end of the process. The effect of cylinder rotation, feed port speed, flow rate and liquid viscosity on the profiles obtained is analyzed.

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