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STUDY OF “EMBOSSING” BY CASTING, CURING AND PEELING ON A PATTERNED ROLL

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Micrometer-scale patterned coating is a key technology for the mass production of certain functional coated products. An attractive method is to cast a layer of liquid resin between a tensioned flexible web and a roll surface patterned at micrometer-scale, to UV-cure the resin, and to peel the cured film on its web from the roll. The operability of each step is limited by line-speed, scale and texture of the roll surface's pattern, wettabilities and other factors. The mechanisms responsible for limitations are poorly understood.

We studied the steps in “embossing by continuous UV replication” with a convenient tabletop apparatus designed for the purpose. Air entrapment in the grooves of various patterns during casting was visualized, modeled theoretically, and related to the casting conditions. Resin behavior during curing was visualized through the transparent web, and temperature rise was monitored. Details of the peeling were also visualized and the fidelity of “embossing” was measured. Results were correlated with UV-resin shrinkage, web tension, and roll surface treatment.