In-Line UV Coating Web Heatset

Sappi Printer Technical Service

877 SappiHelp (727 7443)

Problem

In-line UV curable coatings may greatly vary in performance with respect to substrate adhesion, retained gloss, blocking, flexibility, and odor depending upon coating formulation in conjunction with substrate characteristics, equipment application, and curing processes.

Description

UV curable coatings are formulated from oligomers, monomers, photo initiators, and specialty additives to deliver specific end-use requirements relative to coater design, UV curing system, and press speed. Once the proper coating formulation has been developed for the application, curing intensity for optimum polymerization must be determined and may vary depending upon press speed, substrate, ink formulation, and ink coverage. Variable curing demands constant on-press observation and process control throughout the press run to minimize the negative affects of incomplete solvent flashing of heatset inks and the possibility for under or over-cure of the UV coating. When proper UV lamp intensity is established for optimum polymerization, there should be no post-cure affect. Poor UV coat performance in web heatset applications can usually be attributable to one or more of the following conditions:

Causes

- Excessive residual solvent and/or waxes in the dried ink film or high glycol content in the fountain solution may result in poor UV coat adhesion. Metallic pigmented inks may also challenge good coat adhesion.
- Excessive residual solvents in the dried ink film may slowly migrate back tothe surface and attack the UV coating resulting in a decrease of both coating adhesion and retained coating gloss. Problems may not be realized until up to two weeks post-press.
- When UV coated on both sides, some smooth-surfaced substrates with high holdout characteristics may develop a low co-efficient of friction (slippery surface) resulting in high surface contact and static electricity causing delivery problems and/or blocking in the pile. (See Sappi technical tip sheet on Cause and Effects of Static Electricity in Paper).
- Non-image areas of more highly absorbent soft-surfaced cover papers may be prone to non-level UV coat dive-in and/or low retained gloss.
- High pile temperatures in conjunction with extreme load pressures may cause blocking.

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— Alkali-sensitive pigments such as reflex blue, rhodamine, violet, purple, and Red Lake C may experience color shade shifts or burnout when exposed to the alkalinity of UV coating. Lighter tints formulated with these pigments are usually more vulnerable than full strength colors.

OVER-CURING

— A brittle surface may result in post-press cracking-at-the-fold.

— Poor scratch adhesion.

— High sheet-to-sheet slip (low coefficient of friction) causing difficulties in delivery and stacking.

— Post-press sheet curl due to excessive surface shrinking of single-sided UV coating.

UNDER-CURING

— Post-press blocking, offset, or low sheet-to-sheet slip (high coefficient of friction) causing sheet stiction and poor delivery jog.

— Poor rub and scratch resistance.

— Objectionable odor.

Options and Solutions

— Use low-solvent, wax-free, and silicone-free inks.

— Use a low-glycol fountain solution formulated to be UV coat compatible.

— The silicone/re-moisturizer unit should always be disengaged prior to the UV coater when coating and/or temporarily disengaged after the coater during marker reticulation testing.

— Web dryer temps should be optimized for full flashing of the ink solvents, which will vary depending upon paper surface and ink (oil) absorptivity rates.

— Static charges can be dissipated by moisture application to the web through the silicone/re-moisturizer unit after UV coating; anti-static materials in the UV coating formulation; and/or an anti-static device in the delivery section of the press.

— Coating formulation, viscosity, and application-to-cure dwell time (press speed) should be substrate-compatible. Highly absorbent substrates may demand the application of an overall wax-free varnish to improve holdout, flow, and level of the UV coating while minimizing dive-in.

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- Maximize air flow through the curing system to exhaust counter-productive hot air from the UV lamps, and maintain incoming chill roll temps to 55° F. (13° C.). Ideally, the web should return to ambient room temperature.
- Inks should be formulated with fade resistant pigments to prevent burnout and color shifting. Ink suppliers should be advised that special PMS and match colors need to be UV coat compatible.
- UV coatings will offer the best flexibility when properly cured and specially formulated for high pliability to meet certain end-use demands such as die-score and fold.
- Optimize lamp intensity with press speed to efficiently cure UV coating without under or over-exposure.

ON-PRESS TEST METHODS TO DETERMINE PROPER UV CURE AND ADHESION

- UV reticulation test with Berol tip black marker. Be sure that the silicone/water re-moisturizing unit is disengaged before performing this test.
- MEK (Methyl Ethyl Ketone) and Q-tip double-rub; one back and forth motion equals one double-rub. Different coating formulations will have different requirements for MEK resistance depending upon pre-determined application requirements. The typical expectation is five double-rubs before the ink starts smearing. Consult with coating supplier.
- Coin-rub for scratch adhesion.
- Taber Abrasion Test with 250 gram weight and CS-17 wheel.

The Taber Abrasion Test is a good measure of UV adhesion both immediately off press and then again two weeks post-press. If adhesion of the UV coating deteriorates after two weeks post-press, it is a good indication that residual ink solvents are migrating to the surface and compromising both UV gloss and adhesion. Although quite stringent, this test is indicative of how a UV coated catalogue cover may stand up to the rigors of mailing.

Another good test to check for excessive solvent retention and resurfacing is to take gloss meter readings immediately off press and again two weeks post-press. If gloss levels significantly decrease after two weeks post-press, it is a good indication that resurfacing ink solvents may be compromising the UV coating.

Since paper absorbency characteristics vary, a press log charting on-press and post-press performance may be helpful in providing optimal starting points for repeat business. Aside from paper, ink, fountain solution, and coating specs, key performance criteria should also include coating viscosity, press speed, web dryer/chill temps, and test results.

Check with UV coating suppler for the appropriate test specifications depending upon application, formulation, and end-use.