TECHNICAL C&A INFORMATION

COATINGS & ADHESIVES CORPORATION

Raised Image UV Coating - Sheetfed v1.1

Raised image UV coating products can bring depth, contrast and a tactile enhancement to a printed piece, but is a specialized technique that requires proper planning, application equipment/materials and experience to make it an achievable and repeatable process. The result of a properly produced raised image piece is a significantly raised/relief coating film, clean/detailed edges and a relatively smooth film surface.

Application Considerations

Design/Layout	Placement of raised image coating on graphics should not be positioned in areas that will include scoring, folding or cutting. Due to the thickness, raised image UV coatings may crack when subjected to these processes. The use of raised image UV coating against a dark background color will help provide good contrast and allow the effect to stand-out on the printed piece.
Adhesion	Testing the adhesion properties of the raised image coating over inks, primer coating and substrate should be conducted prior to production. When applying a raised UV coating in a spot-application in a separate pass over a flood UV coating film, care should be taken as not to cause the paper to become dry and brittle, the ink film to shrink or the ink to soften due to the repeated heat exposure in the UV curing process. In each scenario, adhesion issues can result.
Paper	Care should be used in paper selection to minimize paper cracking during the printing and finishing processes. Heavy basis-weight papers are most desirable to maintain the integrity of the paper and prevent distortion/curl that can be caused when using raised image UV coatings. Distortion/curl can be related to the raised image graphics and the grain direction of the paper.

Process Materials

UV Coating Product	Raised image UV coating products are specialized formulations that enable a very thick film to be applied while maintaining good characteristics for film cure-response, flexibility and adhesion. Additionally, raised image coatings are generally much higher in viscosity compared to general-use UV products, so formulation enhancements are made to ensure proper film leveling to achieve a smooth surface while retaining good image detail and clean perimeter edges. Robust defoamer and anti-foam capabilities are also built into the formulation to ensure good run-ability/performance within the coating circuit.
Anilox Engraving Selection	Due to the amount of coating required to achieve a significant raised image relief, an anilox with a much higher volume is required compared to a general-use UV coating product. While a general-use UV coating product may use an anilox volume of 12-14 bcm, a raised image UV coating will generally require an anilox volume of >40 bcm to achieve desired results. In this case, a special “open-cell” engraving pattern such as Tri-helical or Reverse-Engraving may be required to create a roll with the necessary volume/bcm and release/transfer characteristics to achieve the desired results, while avoiding the issues of chamber-foaming that can occur with a “closed-cell” engraving. In cases where extremely high coating volumes are desired, a diamond engraving can be employed to control the coating application rate to avoid over-application or spitting/slinging.

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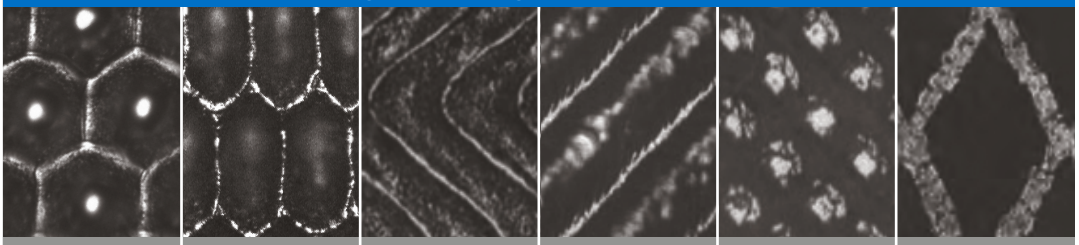
Raised Image UV Coating - Anilox Recommendations



	Hexagonal	Elongated Hex	Channel-Wave	Tri-helical	ART(Pins-up)	Diamond
Cell Structure	Closed	Closed	Open	Open	Open	Closed
Engraving Angle	n/a	n/a	n/a	45° / 60°	45° / 60°	45° / 60°
Volume Range, BCM	n/a	n/a	n/a	30 - 60	30 - 60	40 - 85
LPI	n/a	n/a	n/a	60 - 120	60 - 120	40 - 100
Raised Image Coating	●	●	●	●	●	●

Process Materials - *continued*

Anilox Engraving/ Coating Viscosity Correlation

The use of a high volume anilox roll for raised image UV coating application creates a very “open” engraving, which mean that the roll does not contain the necessary wall structure to hold a low viscosity coating in the cell. If the coating viscosity is too low relative to the anilox cell structure, the coating will flow out of the anilox cells resulting in slinging, spitting, containment blade reverse-doctoring and excessive coating application to the coating plate. The excessive application rate to the coating plate can result in beading along the image edges, loss of image detail and a rough, orange-peeled surface. Comparatively, if thecoating viscosity is too high compared to the anilox volume/cell structure, the transfer efficiency can become reduced and the application rate to the coating plate can become insufficient to achieve a desired raised image effect. Due to these potential problems caused by low/high viscosity, it is necessary to match the coating viscosity to the anilox roll engraving to ensure that the coating meters correctly and proper release/transfer to the coating plate is achieved. While most general-use UV coating products for sheetfed applications have a viscosity range of 250 - 350 cps, a raised image UV coating can have a viscosity range anywhere between 800 - 1800 cps.

Chamber System Metering-Blade Selection

It is important that the anilox roll surface is metered completely clean prior to transfer to the coating plate to avoid spitting/slinging, containment blade reverse-doctoring and excessive coating transfer that may result in poor image quality and beading. The use of a steel or ceramic coated steel blade material provides the best metering due to rigidity with a narrow anilox contact profile. The use of composite blade materials can promote increased wear resistance compared to steel due to a lower COF against the ceramic roll surface, however, the increased blade thickness that is required to create rigidity detracts from the metering capabilities. Flexible plastic blade materials should be avoided in the metering position as they cannot provide sufficient metering as they can become lifted and separated from the anilox surface by the high viscosity raised UV coating, particularly when using an open engraving pattern. The use of a ceramic coated steel blade material will provide the most longevity for blade wear.

Chamber System Containment-Blade Selection

Un-like the metering blade position, the containment blade position requires a very flexible blade that can flex/bend and allow any residual coating on the surface of the anilox walls to pass through and re-enter the chamber opening. If the containment blade is too rigid, any coating on the roll surface will become reverse-doctored and build on the containment blade surface. A flexible polyester blade material is most suitable for this position.

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Process Materials - *continued*

Coating Plate Material	Typically, raised image UV coatings are applied to create very precise and detailed images which requires an analog or digitally imaged polymer relief coating plate. These plates provide a very smooth and hard surface for coating transfer from the anilox roll and to the substrate. In order to ensure proper and repeatable fit, performing a print-length/distortion test is advised by the plate material supplier to account for any print-length variance that is inherent in the coating process using a relief plate. When performing a distortion test, it is important to confirm and document all materials and settings including: coating relief plate/thickness, under-lay material/thickness and coating plate tension/torque. Always measure and confirm the actual material thickness and document for reference. It is important that the coating plate is imaged with support bars or "bearer bars" to support the anilox and substrate and control both application and impression contact pressures. These support bars run circumferentially within the paper margin but outside of the job image area to provide continuous contact of the anilox to the coating plate in areas where there is no job image area. This ensures that the contact pressure of the anilox to coating plate remains consistent and that there is no abrupt contact or pressure difference at the lead or rear edges of the job image area that could contribute to beading, variance in coating film thickness or poor image quality. Additionally, these support bars maintain constant impression contact to the substrate which prevents the substrate from moving freely on the impression cylinder surface if no contact was present.
Coating Pumping System	Since raised image UV coating products are generally higher in viscosity compared to general-use UV coating products, it may be necessary to use a special coating pump to avoid chamber starvation due to poor pumping/circulation. This can be dependent on the coating area of coverage and press speed which will determine the consumption rate for the raised image UV coating in terms of the coating pump being capable of pumping at the necessary rate to keep the coating chamber filled. Diaphragm pumping systems may be unable to properly pump a high viscosity coating product at the needed rate to keep the chamber filled. In this case, an alternative pumping system such as peristaltic may be required, due the ability to effectively pump high viscosity liquids. Peristaltic pumping systems are capable of creating more consistent coating flow and less entrained-air foaming compared to diaphragm pumps, which can improve the quality of the raised image results.
Mixing System	Raised image UV coating products should be mixed thoroughly prior to circulation. The use of a drum-mixer is recommended when available. During raised image UV coating use, continued slow agitation is recommended.

Process Considerations

Press Speed	Using a high volume anilox roll can necessitate a reduced press speed to avoid issues of coating spitting, slinging and misting. Additionally, in order to produce a smooth coating film surface, increased dwell after coating application and before EOP(End-of-Press)-UV curing may be required by reduced press speed.
Chamber-Anilox Contact Pressure	Chamber contact pressure to the anilox roll should be minimized to optimize metering while reducing blade wear. Excessive chamber contact pressure to the anilox can result in the metering blade flexing inward and lifting which can contribute to insufficient metering of the roll surface and heavy coating application. A good practice is to incrementally reduce overall chamber contact pressure to the anilox until the roll surface is visibly covered with heavy coating, then incrementally increase chamber contact pressure to the anilox until good metering is observed. If the contact pressure to the anilox appears uneven/nonparallel, it is important to re-set the chamber contact to the anilox using the method/settings prescribed by the chamber/press manufacturer.

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Process Considerations - *continued*

Application: Anilox-Coating Plate Contact	Application contact should be minimized to provide sufficient coating transfer to the coating plate surface while avoiding excessive pressure which can contribute to quality issues. Observation of a coating-stripe of the anilox to the coating plate can be an acceptable method to determine proper application contact, setting a minimum stripe recommended by the press manufacturer. If an accurate coating-stripe cannot be achieved due to the high anilox volume, the use of a "break-away" method can be used by incrementally reducing application contact pressure until an incomplete coating image is achieved, then incrementally increasing application contact pressure until the coating image area is complete. Insufficient application pressure can result in an incomplete coating image or a rough coating film surface. Excessive application pressure can result in beading along the image area relief edges, in particular the lead and rear edges and loss of image detail.
Impression: Coating Plate-Substrate Contact	Impression contact should be minimized to provide sufficient coating transfer to the substrate while avoiding excessive pressure which can contribute to quality issues. The use of a "break-away" method can be used by incrementally reducing impression contact pressure until an incomplete coating image is achieved, then incrementally increasing impression contact pressure until the coating image area is complete. Insufficient impression pressure can result in an incomplete coating image or a rough coating film surface. Excessive impression pressure can result in beading along the image area relief edges, in particular the rear edge and loss of image detail. Additionally, excessive impression pressure can meter the raised UV coating film applied to the coating plate surface by the anilox resulting in a loss of film thickness and a poor/insufficient raised effect.
EOP-UV Curing	Cure-response for raised UV coating is formulated to account for reduced press speeds and increased dwell of the EOP-UV curing system. Typical EOP-UV settings for general-use UV coatings can be employed without over-cure of the raised UV coating despite reduced press speed. Raised image UV coating is formulated with improved film flexibility to prevent a fragile film if over-cure does occur.
Infrared(IR) Exposure	The use of low-power IR emittance can be used if available to heat the raised UV coating film on the substrate to improve leveling to achieve a smooth coating film surface prior to EOP-UV curing. Care should be taken when using IR as the applied raised UV coating film can have significant heat retention which can contribute to quality issues in the delivery-pile. Always avoid the use of Hot-Air-Knives(HAK) or other forced-air sources on the raised UV coating film prior to curing as this can disturb the film surface and contribute to cured film roughness.
Photo-Bleaching	Raised image UV coating products can contain photo-initiators that photo-bleach. These PI's are used to allow the penetration of UV light into heavy/thick coating films, especially if beading is present due to excessive application/impression contact pressure settings. These PI's absorb the blue-end of the visible light spectrum and are yellow in color, absorbing wavelengths above 400 nanometers. The original yellow color of the coating photo-initiator being used should disappear with photolysis, becoming colorless over a short period of time. The photo-bleaching effect has two advantages: a.) as long-wavelength UV penetrates the coating film, the coating becomes transparent, and light is able to penetrate into the coating to allow deep cure of heavy/thick coating films; b.) continuous exposure to UV light around 400 nm, or to visible light, will bleach the cured film to give a colorless product. PI's that photo-bleach provide excellent depth cure. When running raised image UV coatings, the observation of a temporary yellow tint in the coating film is common. The applied raised image UV coating film will photo-bleach and lose the yellow tint, typically in 15 - 30 minutes off-press when allowed to cool.

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