BRADEN SUTPHIN
INK COMPANY
THE COLOR OF LEADERSHIP
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Offset Metallic Inks – Issues In Coating

It is not recommended to apply UV cured off-line coatings over conventional (not uv cured) metallic inks without significant attention to and testing of all of the components in the manner in which they are planned to be used – in the printing plant production environment. Laboratory testing is not sufficient to make a determination as to the viability of the materials combination.

This document will address issues relating to conventional (non UV cured) metallic offset inks and subsequent coating of these metallic inks. There are problems associated with this combination that can result in lost time, printed work, and money; not to speak of unhappy customers.

The issues begin with the properties of metallic inks. The primary reason for using a metallic ink is to achieve a metallic sheen in a printed piece. These inks are formulated using either aluminum or bronze (silver and gold respectively) colorant. That colorant, by design will align at the surface of the printed ink film to achieve maximum metallic sheen. The vehicle or carrier, by design, allows this "float" to occur; in fact it is designed to encourage this surface alignment. There is also a certain amount of penetration of vehicle into the surface of the substrate. Substrates such as SBS board or Carolina Cover have less "hold – out" so there is more absorption of vehicle into the substrate. Bear in mind that the vehicle is also going to function as the binder of pigment to substrate. The more of the binder that absorbs into the substrate, the less that will be available to bind the metallic colorant to the substrate. What is left is a loosely bound layer of metallic colorant at the printed surface which makes for a "brilliant" metallic look. (Anyone who has run their finger over an unprotected metallic print can attest to the loose bind. See illustration.) This also results in rubbing & marking issues, particularly on packaging and covers. Thus the need or desire to protect metallic printed material with a varnish or coating.

In most cases an aqueous coating applied in-line will provide adequate protection against rubbing and marking as well as tape "adhesion". An aqueous coating is low in viscosity and easily flows into the peaks & valleys and interstices in the print surface. The drying mechanism for aqueous coatings is not instantaneous and provides a flexible "plastic" film that flexes and moves as both ink and coating go through their final drying phases. The result is a well bound pair of films that provide adequate rub resistance, but not a high gloss finish. The desire

for extremely high gloss on many packages leads to experimentation with UV cured coatings which do provide extremely high gloss, but bring new problems.

First of all, there is a radical difference in 1) the general chemistry and 2) the drying/curing process between “conventional” materials and UV cured materials. The different chemistry drives difficulties in “wetting” and “binding” a UV coating to conventional ink and coating. Most coating films shrink slightly as they cure. A UV cured coating shrinks essentially instantaneously which can cause a break in the overall layer at the weakest link. If there is poor surface adhesion of coating to print then the UV cured coating film will easily break away from the surface it’s applied to. (Tape adhesion, “nickel” scratch tests)
Second, because of the behavior of metallic ink colorant (orienting at the print surface) as the metallic ink sets and dries (either with or without a primer) this leaves this poorly bound layer of aluminum or bronze powder at the surface of the metallic ink film. When a subsequent UV cured coating is applied this loosely bound layer can fail in terms of adhesion of the UV cured coating to the printed film. A primer coating will likely not substantially prevent this as the loosely bound layer forms in the hours after printing and in-line primer coating. If the primer is functioning well, the UV cured coating adheres well and during the UV curing as the UV coating film shrinks, the break-away takes place between the primer and the ink film (the weakest link). A tape adhesion test will demonstrate this. Usually, in these cases the tape will pull a layer of the metallic ink film along with the UV and primer coatings. This is a result of the metallic ink film splitting due to the loosely bound layer of metallic colorant. This failure is not due to a materials failure – it is *because all the materials are doing what they are designed to do*.

Options

There are options to evaluate that will minimize (not eliminate) issues with UV coating adhesion over metallic inks. The key to this is having sufficient binder remaining in the ink film to hold on to the metallic colorants.

The single most influential component in this combination is the absorptive characteristic of the substrate. The more absorbent the substrate is, the more problematic it will be. A lower absorbency substrate keeps more ink binder on the surface of the substrate thereby providing improved binding of metallic colorant in the ink film which improves the overall binding of materials applied over the metallic ink.

A secondary option is to use a metallic ink that is higher in binder level to begin with. Manufacturers of metallic inks have alternative formulations available which are essentially lower metallic content and higher in oxidative components and binders. This allows a more positive binding of colorant into the ink film. The trade-off here is that there is a lower metallic “luster” proportional to the reduction of metal colorant content.

A third option is to in-line apply an oil based OPV designed to accept off line UV curable coatings.

A final consideration is that it is usually desirable to minimize the time between printing of the metallic and UV coating the printed film.

It is highly recommended that various combinations of these options be tested and monitored under production conditions, as specific printing conditions (ambient environment, fountain solution type and mix ratios, impression, etc.) can and do vary greatly from one pressroom to another.