

Energy-Cured Coatings – Metallic Ink Pigments

Scope

- Metallic ink pigments used in lithographic inks are substantially different in nature than conventional color ink pigments – the particle size of the metallic pigments, normally bronze or aluminum, are substantially larger than conventional color pigments.
- To produce the highly reflective and brilliant ink film surface, the metallic ink pigment is produced in a flake or lamellar shaped powder.
- Pigment loading of metallic ink is much higher than that of a conventional color ink – the high concentration of these specialized metallic ink pigments can make adhesion of an applied energy-cured coating film difficult, so precautions much be taken to ensure successful results.

'Leafing' Pigments

- Unlike round-shaped conventional color ink pigments that reflect light in different directions, metallic flakes achieve specular light reflectance to create a highly reflective 'metallic' appearance.
- To optimally reflect light to achieve the highest degree of reflectance and brilliance, the metallic flake in the applied ink film requires a parallel orientation to the substrate surface at the ink film surface – this 'leafing' pigment effect, is like leaves floating on the surface of water.
- While the leafing pigment is most desirable for producing the most dramatic visual appearance, the possibility of the leafing metallic pigment to not be properly secured/anchored to the paper surface by the resin ink binder exists – the leafing pigment will sit on top of the binder like a leaf floating on top of water.
- In this case, the result can be the detachment of the metallic flake from the paper surface in the appearance of smearing, burnishing or 'chalking' – this can be most prevalent if using low hold-out/high-absorbency papers where the ink binder becomes absorbed, creating a separation of the metallic pigment flake and resin binder.
- On printed sheets that do not have a protective topcoat (waterbased or energy-cured coating) applied over the metallic ink surface, the result will be the metallic ink pigment easily rubbed from the paper surface despite the ink film being completely dried/cured – wiping with a finger will result in the metallic ink pigment smearing/chalking on the paper surface and transferring to the finger.
- When an energy-cured coating is applied over the metallic ink surface, the result can be energy-cured coating scratching/flaking caused by the under-lying leafing ink pigment becoming detached from the paper surface – when conducting a tape-pull to test adhesion, the result will be a split at the ink film layer.
- Metallic inks with leafing pigments can also have low surface energy/tension which makes good adhesion of an energy-cured coating film difficult to achieve.

Non-Leafing Pigments

- Non-leafing ink pigments can be substituted with improved adhesion results – the pigment concentration and loading remain relatively high which means that the pigment is still not as secured/anchored by the ink binder compared to other conventional color inks.

Stearic Acid

- Stearic Acid is a saturated fatty acid that comes from animal and vegetable fats and oils.
- Waxy solid that is used to prevent tarnishing of the metallic pigment during storage and is employed when converting the pigment into an ink or coating.
- Stearic Acid prevents tarnishing of the metallic flake by encapsulating the flake with a waxy/greasy moisture resistant barrier – if an un-treated bronze pigment is exposed to water, it will begin tarnishing and lose its bright golden color, like bronze domed buildings that have been exposed to moisture and become discolored to a greenish patina.
- To avoid having the pigment tarnish and shift in color prior to or after printing, the metallic flake is treated with Stearic Acid to minimize any discoloration.
- An additional benefit of Stearic Acid is that the waxy substance also helps to promote metallic ink pigment leafing by forming an oily residue surrounding the metallic powder so the individual flakes do not stick together or clump themselves in a manner which would negate the desired reflectance causing a loss of the brilliance and metallic appearance of the final ink film.
- Stearic Acid can hinder proper adhesion of energy-cured coatings to the dried/cured metallic ink film.

Energy-Cured Coatings – Adhesion Promotion to Metallic Ink

<i>Over-Print Varnish</i>	<ul style="list-style-type: none">- For the best adhesion when using metallic ink and energy-cured coating in-line, an additional wax-free/imprintable over-print varnish should be applied in-line over the metallic ink prior to coating.- The over-printing imprintable varnish film will help to protect the metallic pigment from easily detaching by applying an additional binder layer to anchor the pigments to the substrate.- The wax-free varnish film will also create an imprintable film surface for energy-cured coating adhesion and a barrier that prevents the metallic pigment from being in direct contact with the applied coating film.- The use of an imprintable over-print varnish can be particularly important when using low hold-out/high-absorbency papers where pigment-binder separation can be most severe.- Varnish will have a minimal effect on the appearance and brilliance of the metallic ink when applied sparingly.
<i>Primer Coating</i>	<ul style="list-style-type: none">- When applying coating directly over a metallic ink film, energy-cured coatings generally experience more adhesion and flaking problems compared to waterbased coating – this can be due to chemistry and surface tension differences between waterbased and energy-cured coatings.- The use of a waterbased primer coating applied in-line over metallic inks can improve adhesion and prevent flaking of energy-cured coating when applied in a separate pass over the dried ink/primer coating films.
<i>Energy-Cured Coating Selection</i>	<ul style="list-style-type: none">- When selecting an energy-cured coating product for use over metallic ink, a high-flexibility and high-adhesion coating product is recommended.
<i>Paper Selection</i>	<ul style="list-style-type: none">- Avoid using matte/dull paper types that have a low surface hold-out and high absorbency – coated stocks with good hold-out properties are recommended.