



## UV Coating Adhesion - Metallic Inks

Metallic pigments used in printing inks are substantially different in nature than conventional color ink pigments. The particle size of the pigments, normally either bronze or aluminum, is substantially larger than conventional color pigments. To produce the leafing-brilliant effect, the metallic ink pigment is produced in a flake or lamellar shaped powder. Additionally, to achieve good coverage and ink densities, the pigment loading of metallic ink is much higher than that of a conventional color ink. These specialized and increased concentration metallic pigments contained in metallic inks make adhesion of UV coating films difficult, so precautions must be taken to ensure successful results.

### Metallic Ink Pigments

#### Leafing Pigments

Unlike round-shaped conventional color ink pigments, metallic flakes reflect light at different angles to create a “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 paper layer at the ink film surface. This “leafing” pigment effect, is similar to leaves floating on the surface of water. While the leafing pigment is most desirable to produce the most dramatic visual appearance, the possibility of the leafing metallic pigment to not be properly secured/achored to the paper surface by the ink binder exists. In this case, the result can be the detachment of the metallic flake from the paper in the appearance of burnishing or “chalking”. This can be most prevalent if using low hold-out/high-absorbancy paper where the ink binder that secures the pigment to the paper becomes absorbed, causing a separation of the metallic flake and binder. On printed sheets that do not have a waterbased or UV coating applied over the metallic ink surface, the result will be chalking, where the pigment is easily rubbed from the paper surface despite the ink film being completely dried. When a UV coating is applied over the metallic ink surface, the result can be UV flaking caused by the under-lying leafing ink pigment becoming detached from the paper surface. Metallic inks with leafing pigments can also have a low surface energy/tension which makes good adhesion of a UV coating film difficult to achieve.

#### Non-leafing Pigments

Non-leafing ink pigments can be substituted with improved results, however, the pigment concentration and loading remains relatively high which means that the pigment is not as secured/ protected by the ink binder component compared to other conventional color inks. In addition to the pigment and binder ratio being low, metallic powders like any metal can tarnish and are normally treated with Stearic Acid.

#### Stearic Acid

Stearic Acid is a saturated fatty acid that comes from animal and vegetable fats and oils. It is a 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 un-treated bronze pigment is exposed to water, it will begin tarnishing and lose it's bright golden color, similar to bronze domed buildings that have been exposed to moisture and become discolored to a green-ish patina. To avoid having the pigment color change prior to or after printing, the metallic flake is treated with Stearic Acid to minimize any discoloration. An additional benefit of the 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 orient themselves in the same direction which would negate the desired reflectance causing a loss of the brilliance and metallic appearance of the dried ink film. Stearic Acid does not contribute to and can hinder proper adhesion of UV coating to the dried metallic ink film.

## UV Coating Adhesion Promotion

<b>Over-Print Varnish</b>	For the best adhesion when using metallic ink and UV coating in-line, an additional wax-free over-print varnish should be applied in-line over the metallic ink prior to UV coating. The over-printing wax-free varnish film will help to protect the metallic pigment from easily detaching by applying an additional binder film to anchor the pigments to the substrate. The over-printing varnish film will also create an imprintable film for UV adhesion and a barrier that prevents the metallic pigment from being in direct contact with the UV coating film. The use of a wax-free 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 run sparingly.
<b>Waterbased Primer Coating</b>	When applying coating directly over a metallic ink film, UV coating generally experiences more adhesion and flaking problems compared to waterbased coating. This is due to chemistry and surface tension differences between waterbased and UV coating. The use of a waterbased primer coating applied in-line over metallic inks can improve adhesion and prevent flaking of UV coating when applied in a separate pass over the dried ink/coating films.
<b>UV Coating Selection</b>	When selecting a UV coating product for use over metallic inks, a high-flexibility and high-adhesion product is recommended.