Basics of UV Inks and Coatings

What Are UV Inks and Coatings?
UV inks and coatings are applied as liquids, but upon application and after exposure to UV light they instantly cure to a solid film. UV coatings are most often used in printing and packaging to provide protection and improve the look of printed surfaces.

How Do UV Inks and Coatings Work?
UV inks and coatings contain materials that react to a specific wavelength of light. The coating absorbs energy from UV light, which triggers a chemical reaction in the coating. In a fraction of a second, the liquid coating is converted to a solid. This is accomplished without the use of solvents or expensive drying systems. The UV curing process consists of three stages:

• Stage 1 – the uncured state, the UV coating is a liquid.
• Stage 2 – the coating is exposed to UV light
• Stage 3 – the cured state, the coating becomes a solid film

What is Ultraviolet Light?
UV light falls between visible light and X-rays on the electromagnetic spectrum. UV light is provided by powerful lamps that emit the required wavelength of UV light.

What Are UV Inks and Coatings Made of?
Even though they are applied in liquid form, most UV coatings contain no solvents or volatile organic compounds (VOCs). They are comprised of a blend of acrylic-based materials, including petrochemicals. The major components of most UV coatings are:

• Monomers (reactive diluent)
• Oligomers (pre-polymer)
• Photo-initiator
• Additives (silicon, wax)

Why Use UV Inks and Coatings for Printing and Packaging?
Commercial printers use UV-cured inks and coatings to catch the consumer’s attention with high glosses and special effects, which provide a premium image on all types of printed materials. The key advantages fall into three key categories:

Visual Impact
Compared to most other types of print production, UV inks and coatings offer outstanding gloss and clarity. A wide range of gloss levels can be achieved (ultra-high gloss, semigloss, satin or matte). There are many different types of UV coatings available that give the ability to achieve unique visual effects that cannot be achieved with other coating types.

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Production Efficiencies
UV inks and coatings offer outstanding durability and performance properties compared to most other methods of print production. They result in excellent abrasion resistance which protects the print or packaging better than other inks and coating types. In addition, because UV inks and coatings cure almost instantly, printers can achieve high production speeds and immediate processing of printed materials. Unlike with other types of inks and coatings, no spray powder or short-stacking is required to prevent offsetting. Also, the UV process uses less energy than other ink and coating types.

Sustainability
Most UV inks and coatings are free of solvents, VOCs and hazardous air pollutants (HAPs). Their energy-efficient processing also results in a relatively low carbon footprint. In addition, UV coatings can be easily removed in most paper and paperboard recycling operations through the de-inking process.

Comparison of Print Production Methods

<table>
<thead>
<tr>
<th>Property</th>
<th>UV Coating</th>
<th>Conventional Varnish</th>
<th>Aqueous Coating</th>
<th>Lamination</th>
</tr>
</thead>
<tbody>
<tr>
<td>Material Cost</td>
<td>Medium</td>
<td>Medium</td>
<td>Low-Medium</td>
<td>High</td>
</tr>
<tr>
<td>Gloss Range</td>
<td>Wide (5-95)</td>
<td>Medium (10-60)</td>
<td>Medium (10-70)</td>
<td>Selective (5-95)</td>
</tr>
<tr>
<td>Visual Effects</td>
<td>Very High</td>
<td>Low-Average</td>
<td>Average</td>
<td>Very High</td>
</tr>
<tr>
<td>Rub/Scuff Resistance</td>
<td>Very High</td>
<td>Average</td>
<td>Average</td>
<td>High</td>
</tr>
<tr>
<td>Durability</td>
<td>High</td>
<td>Low-Average</td>
<td>Low-Average</td>
<td>Very High</td>
</tr>
<tr>
<td>Drying/Curing Speed</td>
<td>Very Fast</td>
<td>Slow</td>
<td>Medium Fast</td>
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<tr>
<td>In-line Application</td>
<td>Yes*</td>
<td>Yes</td>
<td>Yes</td>
<td>No</td>
</tr>
<tr>
<td>Energy Usage</td>
<td>Low</td>
<td>Low</td>
<td>High</td>
<td>Low-Medium</td>
</tr>
<tr>
<td>VOCs/HAPs</td>
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<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
</tr>
<tr>
<td>Recyclable</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
<td>Low Compatibility</td>
</tr>
<tr>
<td>Spot Application</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
<td>No</td>
</tr>
</tbody>
</table>

*Must be used with UV and/or hybrid inks.
FAQs

Why is UV coating more expensive than aqueous coating (water-based OPV)?
UV coatings contain roughly 2.5X the amount of solids of most water-based OPVs. In addition, UV coatings offer higher gloss and rub resistance. However, the main reason is due to the higher raw material cost of UV coatings versus water-based OPVs.

What is the difference between a varnish and a UV coating?
A varnish is typically applied in the ink train of an offset press. A coating is applied using the coating tower of an offset press.

Are the printed pieces made with UV ink and coatings recyclable?
Yes, testing has shown that UV ink and coatings are removable from paper or paperboard during the de-inking step of the recycling process.

GLOSSARY

Abrasion Resistance: The ability of a coating to withstand mechanical action such as rubbing, scraping or erosion.

Burnishing: The typically undesired shiny surface seen when a matte-coated surface is rubbed or abraded.

Dive-In: The phenomenon that occurs when a substrate is too porous and the coating is absorbed into the layers of the stock instead of remaining on the surface.

Dry Back: The phenomenon that occurs when initially glossy UV coating loses some gloss and possibly becomes hazy due to being applied over wet inks.

Fish Eyes: The forming of circular deformations in UV coating, usually caused by contamination or wetting issues.

Gloss: The ability of a surface to reflect light.

H-UV: A method to dry or cure ink on press using an H-UV lamp. A single H-UV lamp (one bulb) can cure up to 400% ink coverage plus coating at maximum press speed. This dramatically reduces the amount of energy required for curing compared to standard UV.

Irradiation: Exposure to UV light or other high energy.

Irradiator: The lamp housing and reflector assembly in a UV curing system.

Lamp: The source of UV light used in exposing photosensitive materials.

Mar Resistance: The ability of the surface of a material to withstand mechanical forces.

Non-volatile matter: The ingredients of a coating composition which after drying (curing) are deposited on the substrate. Non-volatile matter constitutes the dried, cured film.

Orange Peel: A term used to describe the surface of a dried film which failed to flow out to a perfectly smooth surface, thus retaining very small hills and valleys resembling the surface of an orange peel.

Reactive Diluent: A chemical which serves two purposes in a UV formulation: viscosity reduction and providing reactivity with other ingredients for curing.

Thermal Setting: The use of elevated temperatures in setting or curing to obtain a usable form of a product.

Wetting: The unforced, instantaneous spreading of a liquid over a solid substrate.