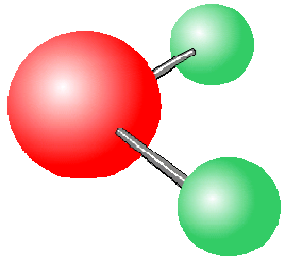


02/08

## CROSS-LINKING CAN OPTIMIZE AQUEOUS COATING PROPERTIES

Marvelous [aqueous](#) coatings have been providing printers with an ever growing list of benefits since they were first proven to be viable in the 1970's.



Foremost, are gains in productivity stemming from the ability to seal oxidizing sheetfed inks, and process the printed result without needing to allow the underlying, still wet, inks time off-line to dry thoroughly. Productivity gains come from being able to combine converting operations such as die-cutting, gluing and packing.

Low VOC aqueous coatings have also played a role in the conversion from solvent based systems by the flexo and gravure printing industry. Here, aqueous coatings fit naturally into a liquid printing system, without the need for additional equipment to apply coatings as is required by the offset printing industry.

The majority of aqueous coatings consist of 30-40% thermoplastic resin solids, combined with additives to improve properties. These may include amine, plasticizer, waxes, surfactant, coalescent aids, and anti-foam all added in small quantities.

Aqueous coatings dry when the water content, about 60% by typical formula composition, is removed leaving the solids components to form a thin film. When the volatile non-solid components are evaporated, the remaining resin molecules join or link together by a process called coalescence. The coating is 90% dry during this fast initial

drying phase, resulting in a coated/printed substrate that can be handled. Post cure that continues over time accounts for the remaining cure/drying and the development of complete coating properties.

Benefits offered by Cork aqueous coatings, aside from the significance of productivity gains, have been long known and include:

- Clean air, low VOC, zero alcohol, non polluting properties
- Fast drying in-line wet trapping
- Recyclability, biodegradability, and repulpability
- Low odor, non-flammability and non-toxicity
- The clarity of water when dry
- No age related yellowing
- A range of finish from high gloss, through satin to matte
- Significant rub, mar and blocking resistance
- The minimization or the elimination of offset spray powder.
- The ability to protect metallic inks while maintaining brilliance
- A range of slip from non-skid to low COF slipperiness
- Grease, and moisture resistance

In addition, an ever advancing aqueous coating technology has been able to provide:

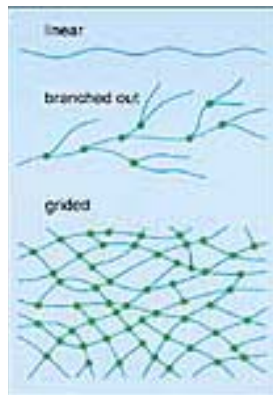
- FDA conformance for both dry and or wet greasy food contact
- Gluability, or glue resistance
- Imprint ability and foil stamp ability
- Ovenable and microwavable packaging heat resistance
- Pre-print liner and paper plate converting heat resistance
- Pouch, and lidding heat resistance
- Grease, alcohol, alkali and improved moisture resistance

- UV coating, film lamination and metallization primers

Periodically, printers request aqueous coatings with properties that exceed those that are normally developed by the coalescing, film forming, drying process. It is here that cross-linking agents have come into play.

### CROSS-LINKING

Cross-linking agents are capable of being utilized to dramatically improve the properties of many aqueous coating and adhesive formulations. Use of cross-linking agents can impart greater strength and flexibility, improve solvent, alcohol and water resistance, heat and alkali resistance, increase hardness and rub resistance, and upgrade adhesion to some difficult substrates.



Polyfunctional aziridine, which acts as a self curing cross-linker or hardener, is a cross-linking agent used as a press room addition. Most applications seeking aqueous product properties improvement find that additions in the 1-3% level are adequate depending on resin solids. An aqueous system pH of between 9.0 and 9.5, at the time of aziridine addition, has been found to most often produce optimum results. A lower pH may cause aziridine to react prematurely in the pot. Aziridine can react with an active H<sup>+</sup>, as found in the carboxyl groups of acrylic emulsions and polyurethane dispersions. This reaction protonates and opens the aziridine ring, which then reacts with the oxygen of the carboxyl groups forming a cross-link network.

An aqueous system that contains a low boiling (volatile amine), such as ammonia or triethylamine, may be expected to have a pot life of about 18-36 hours. If used after this time passes there will be a loss of aziridine functionality. This loss can be overcome by another aziridine addition without any negative effect on expected film properties.

Aziridine must be stored away from any acids or oxidizers. Maximum shelf life (24 months) can be expected when the product is stored between 35° F (1.7° C) and 60° F (15.6° C).

Another cross-linking agent is carbodiimide. It is not as potent as aziridine in its ability to react and produce cross-linking therefore, a larger addition is required to obtain similar results. One would typically choose to use a carbodiimide instead of aziridine because it is more user friendly (safer to handle).

**Proper handling is a must!** Refer to the manufacturers of aziridine and carbodiimide for MSDS, recommended industrial hygiene and other safety precautions.

**CORK Industries** is in the forefront of providing innovative aqueous & UV/EB energy curing specialty coating, varnish, UV ink and adhesive formulations.

### **LOOK TO CORK!**

Cork is 25 years of formulating solutions. We are experienced people, proven products, and are committed to customer service.

**LOOK TO CORK!....** for expertise in formulating aqueous, UV & EB specialty coatings; UV inks; and adhesives.