

Over the past few years, screen printing has become a sophisticated business, expanding into new markets and developing new products just as rapidly. Though many changes are occurring, some things remain the same: the basics of screen making and the chemical foundations on which photosensitive emulsions continue to be developed.

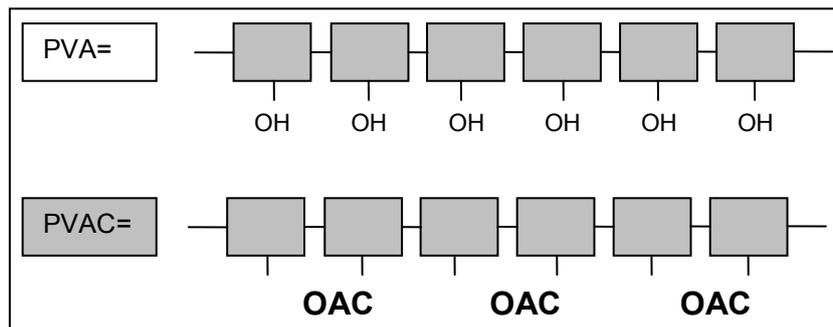
## EMULSION CONTENT

Photosensitive emulsions are made up of three basic elements: sensitizer, water, and solids. The sensitizer reacts to ultraviolet light and the PVA solids link with the sensitizer to form water-insoluble solids.

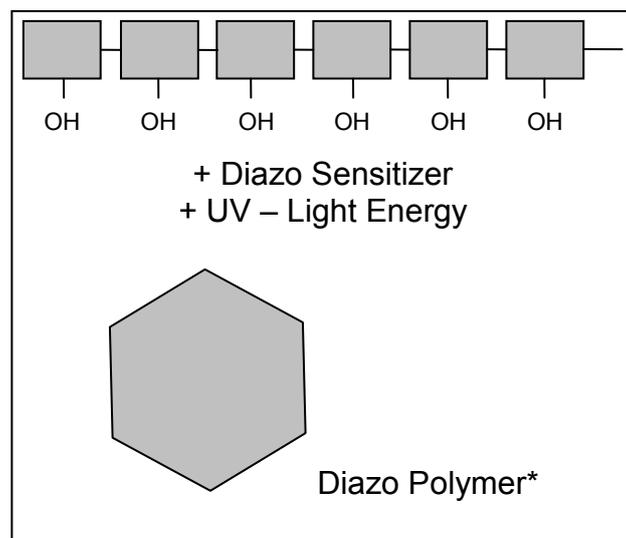
There are three families of photosensitive emulsions today: Diazo, Dual cure and Pure Photopolymer.

Diazo is a PVA and PVAC emulsion that uses only a Diazo sensitizer. The Diazo salts are mixed with the base emulsion prior to use.

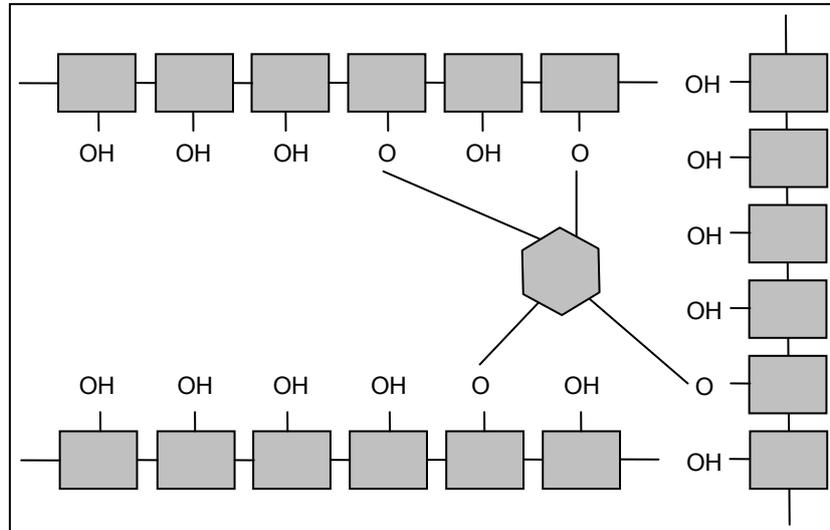
### GENERAL EXAMPLES OF PVA AND PVAC



### THE PVA IS CROSSLINKED BY DIAZO



## PVA CHAIN



Crosslinking with Diazo increases the molecular weight of the PVA materials by linking the PVA chains. The exposed parts are water insoluble, and will remain as the stencil. The non- exposed parts remain water soluble and will wash out, forming the image through which the ink or deposit can pass.

The main use for Diazo cross- linked emulsions is general printing with solvent based inks.

Dual Cure is an emulsion that uses two light- sensitive materials, usually Diazo and photopolymers. Dual Cure emulsions require the mixing of Diazo salt in the emulsion. But, additionally, are formulated with polymers as well. The general components of the polymer portion of the emulsion include acrylate chemicals and a photo initiator. The following describes the mechanism for photocuring of the photopolymer system.

This example is simplified for illustrative purposes:



I= Initiator    M= Acrylate Chemical    R= Terminating Ground

Once again, crosslinking the photopolymer increases the molecular weight of the materials, allowing for a rigid defined reproduction of the artwork desired. Because of their chemistry, dual cure products allow for very sharp reproduction of demanding images.

Dual cure emulsions are normally used for a variety of applications. Co-solvent, solvent and water based inks printing require superior image quality along with the durability required for long print runs with aggressive inks.

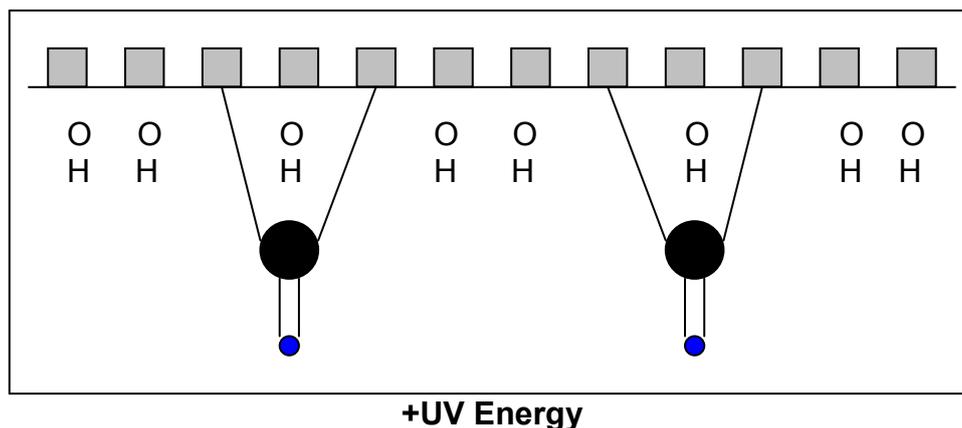
## PURE PHOTOPOLYMERS

The third class of photosensitive emulsions is Pure Photopolymer.

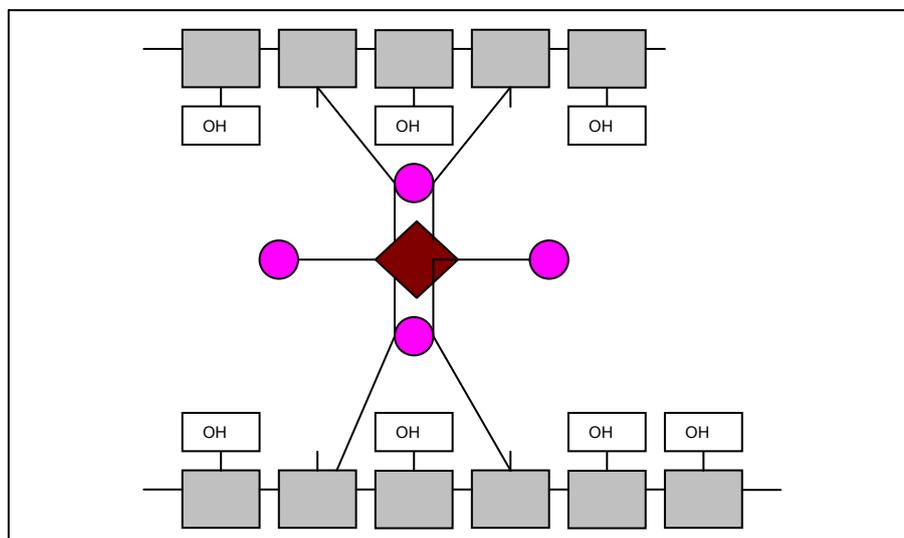
These photopolymer emulsions do not use Diazo as a sensitizer additive. These emulsions are presensitized and do not require mixing. Pure Photopolymer Chain

The photopolymer is generally PVA with a grafted photosensitive group. The following is an example of pure photopolymer crosslinking:

### PURE PHOTOPOLYMER CHAIN



Generally, these emulsions are then formulated with additional non photoactive polymers for the type of printing application needed.



### LIGHT SENSITIVITY

The aforementioned emulsions are all light sensitive. Each of the emulsions undergoes a change when exposed to UV light. These changes are, as discussed earlier, crosslinking. The crosslinking or photo polymerization within the emulsion hardens the emulsion to create a level of stencil durability determined by the emulsion thickness, screen mesh count, exposure time and inherent resistance to solvent.

### GENERAL FEATURES

Finally, the following describes the general features of the three emulsion families – Diazo, Dual Cure and Pure Photopolymer. Though manufacturers develop emulsions differently with specific applications in mind, general comparisons can be made regarding features of these three types of photosensitive emulsions.

Diazo emulsions are heat sensitive, require mixing and have a shorter shelf life. Additionally, they are lower in solids, slower to expose and generally less expensive than the next two emulsions, dual cure and pure photopolymer.

Dual cure emulsions may be heat sensitive, require mixing and have a short shelf life. They are higher in solids than diazo emulsions, are more expensive, but have standard exposures which produce very sharp imaging and durability to all ink types.

Pure photopolymer emulsions, depending on the formulation, generally have higher solids, have short exposures and a long shelf life. They are more expensive than dual cure or diazo emulsions, but do not require mixing and are not as sensitive to heat as the others.

### CONCLUSION

As mentioned earlier, the sophistication of screen making today has not changed the basics, and though chemical developments taking place in the industry today have brought about a variety of emulsion products, photosensitive emulsion basics remain the same.