UV Bulb Type Selection

The selection of the correct UV lamp is critical when designing a curing system for UV screen printing inks. There are three types of UV lamps that are readily available for the curing of UV screen printing inks: Mercury Vapor, Mercury Vapor with Iron Doping, and Mercury Vapor with Gallium Doping. The purpose of the added metals to the lamp is to shift the output wavelength to better match the absorption and transmission spectra of the photo-initiators and pigments in the ink. Fusion UV Systems (now Heraeus Noblelight), who makes microwave ignited (electrodeless) UV curing lamp systems, has popularly coined the names “H-Bulb” for the Mercury lamp, “D-Bulb” for the Iron Doped Lamp, and “V-Bulb” for the Gallium Doped Lamp. You may hear this terminology even for conventional bulbs from suppliers other than Fusion.

The reason this is important to the industrial screen printer is due to the thick ink layers created when screen printing. The UV unit’s power, and line speed combined with the output wavelength and the ink’s formulation all determine the success of curing any given screen print ink. Also of importance is the lamp’s reflector configuration and IR absorbing coatings, chiller rolls, and IR absorbing crystals situated between the lamp and the printed substrate. In general terms, the Mercury lamp is best for curing clear UV screen printing inks and it results in hard surface cures and high gloss finishes. The Iron doped bulb shifts the output of the lamp to between 350-400 nm which improves the through-cure of thick pigmented inks and extra thick clear coats. The gallium doped bulb further shifts the output wavelength toward the visible with a strong output at 400-450 nm. This is important to through-cure white inks that contain the white pigment, Titanium Dioxide. Titanium Dioxide blocks or absorbs shorter UV light. This significantly reduces the energy available for the photoinitiators to generate the free radicals needed to polymerize the coating (convert it to a solid from a liquid).

Other pigment colors can also compete for UV light with the photoinitiator. For example, yellow ink looks yellow to us because it is absorbing the violet/blue (420-430nm) wavelengths and reflecting the yellow (570-585nm) wavelengths. This absorption of the blue is the issue and it reduces the near visible UV light from being absorbed by the photoinitiators. So a pastel yellow or green can be particularly difficult to cure in a thick layer because of the absorption of UV by the titanium dioxide (white pigment) and the yellow pigment.

Functional Inks’ Industrial Screen printing inks are formulated with the best photoinitiators available to take advantage of the doped lamp’s output in order to overcome the competing absorption of the pigments in the formulation. Please see my contact information and call to discuss an application.