Surface Cure Considerations with UV Light-Curable Adhesives and Coatings

Surface tack, or stickiness, may be noticed on the surface of UV light-curable adhesives and coatings. This phenomenon, known as oxygen inhibition, is the result of atmospheric oxygen inhibiting the cure on the surface layer of the polymerized solid. The ability of a UV resin to be cured "tack free" to a slick, dry finish is dependent on the composition of the adhesion or coating formulation and the intensity and wavelength of the UV light.

Rapid development of tack-free surface cures of UV adhesives and coatings is a function of several factors:

1. Intensity generated over the entire UV spectrum
2. Heat generated by the UV light-curing system
3. Exposure time
4. Specific formulation of the adhesive or coating

Generally, short and medium wavelength UV light generated by mercury vapor lamps achieve more efficient surface cures. They do, however, have the limitations of restricted cure depths. Fast cure combined with the better cure depth is achieved by high-intensity lamps generating their peak performance in the longer wavelengths.

Time to cure "tack free" should not be confused with full cure. It is only an indication of the material's ability to overcome oxygen inhibition at the surface of the film when the film is exposed to a given level of light intensity for a specific period of time. For example, a 50 mil film of Multi-Cure® 602-REV-A trapped between a sandwich of Mylar is cured in 15 seconds when exposed to 25 milliwatts/cm^2, yet a 15 mil film of the same material takes over 90 seconds to achieve a tack-free surface when one side of the film is exposed (to the same intensity) in a surface sealing or coating application.

It has been demonstrated that the higher the intensity of the UV light, the lower the total energy level needed to achieve a "tack-free" surface. For example, tack-free surface cure of Multi-Cure® 984-LVUF Conformal Coating takes approximately 30 seconds at an intensity of 200 milliwatts/cm^2. This equals approximately 7 Joules/cm^2 of energy. This same coating cures in 1-2 seconds upon exposure to 2500 milliwatts/cm^2, equaling 2.5 Joules/cm^2 of energy. Though both of the above mentioned cured surfaces feel dry to the touch, the surface cured with the higher intensity exhibits a higher shine, appearing slightly slicker.

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