UV adhesives

Introduction:

UV light curable adhesives are products that cure by exposure to UV light. The curing time is often short so that these products can be used well in a production environment.
Because the UV adhesive must have a "visible contact" with the light source (UV lamp), these products are widely used for coatings, potting, masking and sealing.

Curing mechanism Permacol adhesives:

The Permacol UV adhesives are based on acrylates with a free radical polymerization. Curing starts under UV light, and also stops immediately after removal. For full curing it is therefore important to expose the adhesive in one run until the adhesive has completely hardened.

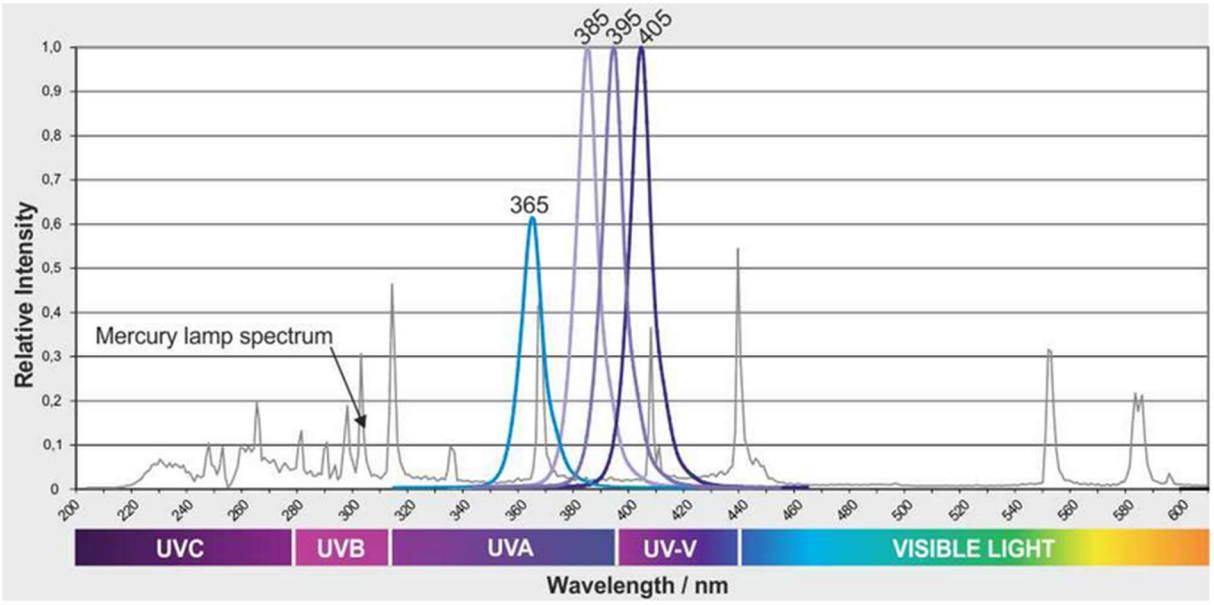
Bonding, coating, or casting:

For bonding two materials to each other, at least 1 of the two materials must allow UV light to pass through. There are plastics that are clear, but have a UV blocker that prevents the UV light from reaching the adhesive. An option could be a curing mechanism with visible light (higher than 400nm), in this way, the UV blocker is put out of action.

When coating or potting electronics, for example, where shadows can be present, the adhesive or coating will not harden properly (fully). An option herein can be the application of a 2nd curing mechanism such as heat or moisture curing.

UV lamps:

UV adhesives are activated by UV light between 315-415nm (UVA range, beginning visible light).
There are mainly 2 options for the UV lamps:
Mercury lamp: This type of lamp is an old acquaintance; a major advantage is the broad light spectrum, so that many types of UV adhesives can be cured with it.
The disadvantage of the mercury lamp is its required warm-up time, it emits a lot of heat (therefore not energy-efficient), and the operational life is relatively low. During the lifetime, the intensity decreases (degradation).
LED lamp: The disadvantages of the mercury lamp are gone with the LED lamp; no warm-up time, no heat output, and a very long operational life without degradation of intensity.
Are there no downsides? A point of attention is the narrow light spectrum that is emitted. This means that the activator in the glue must match the wavelength of the LED lamp, otherwise there will be no activation.



Lichtspectum kwik lamp, vergelijking met UV Led 365, 385, 395, en 405nm spectrum (bron: photoelectronics)

Lamp power:

For proper curing, a correct amount of energy is required to activate the curing mechanism. This energy is named as J/cm², which corresponds to { W/cm² * seconds }. The power (W/cm²) of the UV lamp will have to be given at the correct wavelength (nm).
A minimum of power is required for the curing of an adhesive, sometimes the intensity of the sun can suffice (but uncontrolled), a higher intensity gives faster curing and also prevents oxygen inhibition in coatings. As a general direction, the minimum power is 50mW/cm².
The distance between the light source and the adhesive is also a point of attention; the capacitance decreases quadratically, so 2x the distance from the source is a reduction of 4 in power (W/cm²).

Properties of adhesives:

The following properties are important for the choice and the success of bonding/coating with UV adhesives:
Viscosity: the flow behaviour of the product is important for its use; adhesive or coating, application method, and self-levelling or thixotropic. UV adhesives can be supplied from water-thin to thixotropic.
Curing time/lamp power: The purpose of the correct lamp power and time is to obtain a “full cure” bond or coating. The supplier can give a direction, but the end result will have to be assessed in situ. With full cure, a constant, reproducible, shear strength will be the result. Other tests could be hardness or tackiness.

Oxygen inhibition:

A well-known phenomenon of free radical curing mechanisms is oxygen inhibition. This is a somewhat tacky surface after full cure. And is caused because during curing, oxygen from the environment binds in the surface of the adhesive layer. The rest of the glue is fully cured and usable, but the oxygen inhibition can be experienced as disturbing.
Oxygen inhibition can be greatly reduced or even prevented with higher intensity or shorter wavelength light sources (mercury lamps).

permacol® bv
industrial adhesives

Checklist for use of UV adhesives

- Which materials to glue / pour in
- What is the application method (dosing, manual, pouring)
- Which viscosity is desired (flowing, thixotropic)
- What is the lamp type and intensity
- Does the wavelength of the UV lamp match the activation wavelength of the adhesive
- Is a reproducible curing achieved through a stable exposure time, lamp power, distance between lamp and adhesive layer, and quantity.