Shadow Cure UV Adhesive

Note : The information in this document is subject to change without notice

SHADOW CURE UV ADHESIVE

YOU CAN'T ESCAPE FROM FULL CURE!
Discover the new technology of UV Adhesive from PENCHEM
Webinar On ***5th Mar 2021***, 4.00pm (MY Time)
Speaker: Dr Tracy & Ivan

Content

- ✓ Part A: Chemistry of Adhesives
- ❖ Heat curable adhesive
- ❖ UV curable adhesive
  - i. Radical polymerization
  - ii. Cationic polymerization**
- ❖ UV+Heat post curable adhesive

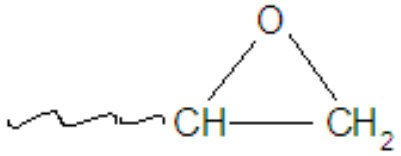
- ✓ Part B: Introducing Shadow Cure UV Adhesive
- ❖ Concept of shadow cure
- ❖ Product selection

PART A1

HEAT CURABLE ADHESIVE

EPOXY RESINS

- What are epoxy resins?
  - A family of thermoset resins which have the epoxide group



  - When reacted with hardener (or curing agent), they set to a hard mass which does not melt or dissolve in solvents.
  - Curing agent: amine, anhydride, DICY

- Epoxy adhesives are supplied in both one-component package and two-component package depending on curing agent used and curing method applied.

  - Two component epoxy system
  - ✓ are prepared by packing epoxy composition and curing agent composition separately.
  - ✓ cure at room temperature

  - One component epoxy system
  - ✓ are prepared and supplied by mixing all formulated components in advance
  - ✓ can be cure rapidly by heat or radiation (UV or Visible light)

PART A2

UV CURABLE ADHESIVE

Benefits of UV curing

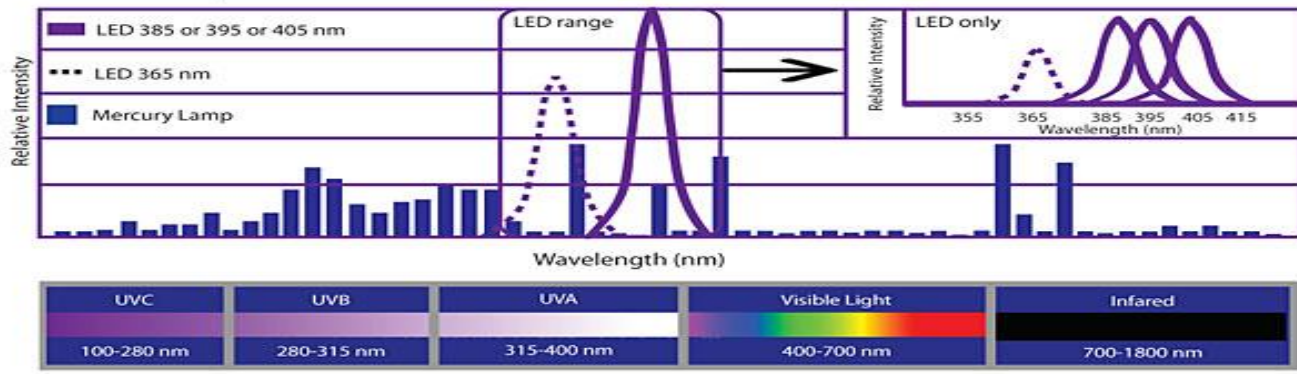
- Instant bonding (snap cure)
- component can be positioned precisely before adhesive harden→Production speeds and capacity are much faster
- Low viscosity light curing adhesives without the use of solvent
- Minimal emissions; ensuring a safer work place

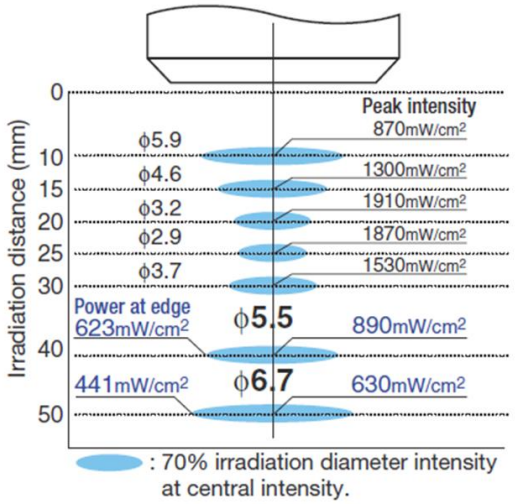
Light Curing Process

Factors affect the cure performances of UV adhesives:

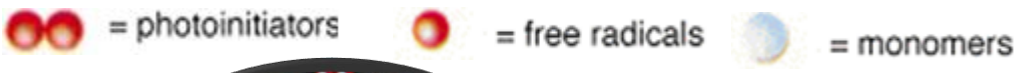
- Type of light sources: mercury arc lamp (broad wavelength) vs UV-LED (narrow wavelength)
- Sport cure (small area) vs conveyor cure (large area)
- Light Intensity (Not recommended to use very low intensity for extended times)
- Fix the distance between the light source and the adhesive
- Light transmission substrates for better cure

FIGURE 1 » Wavelength output comparison of mercury arc and UV LED lamps.





Free Radical Polymerization



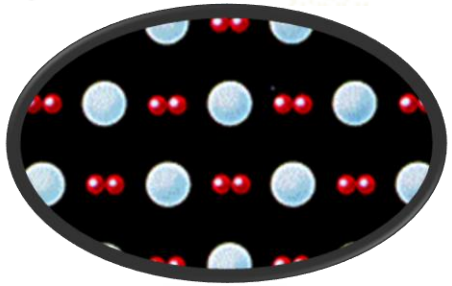
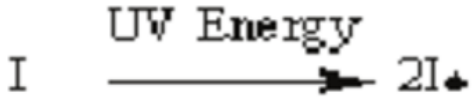


Figure 1: Monomers and photoinitators coexist without reacting with each other



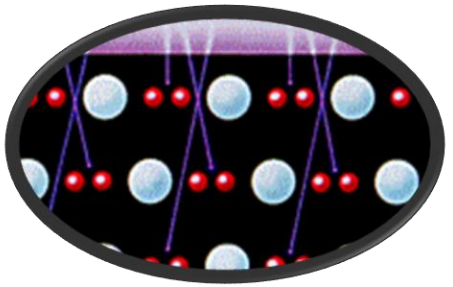


Figure 2: When expose to UV light, PI turn into free radicals.

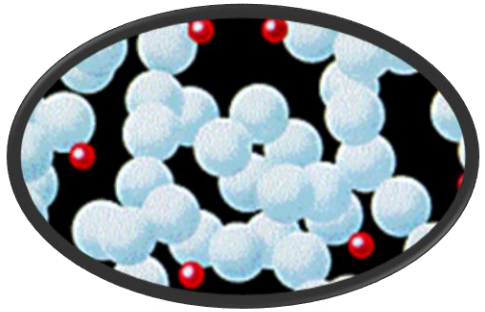


Figure 4: Cross-linked polymer chains in their cured state.

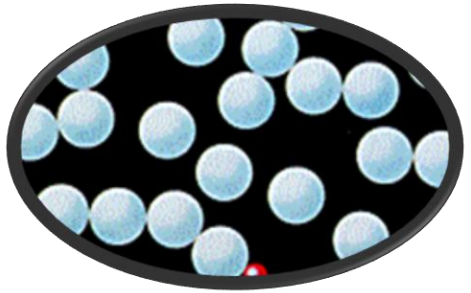
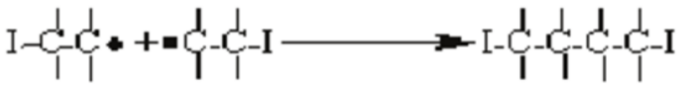
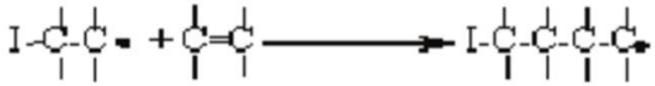


Figure 3: Free radicals initiate the Formation of monomer chains

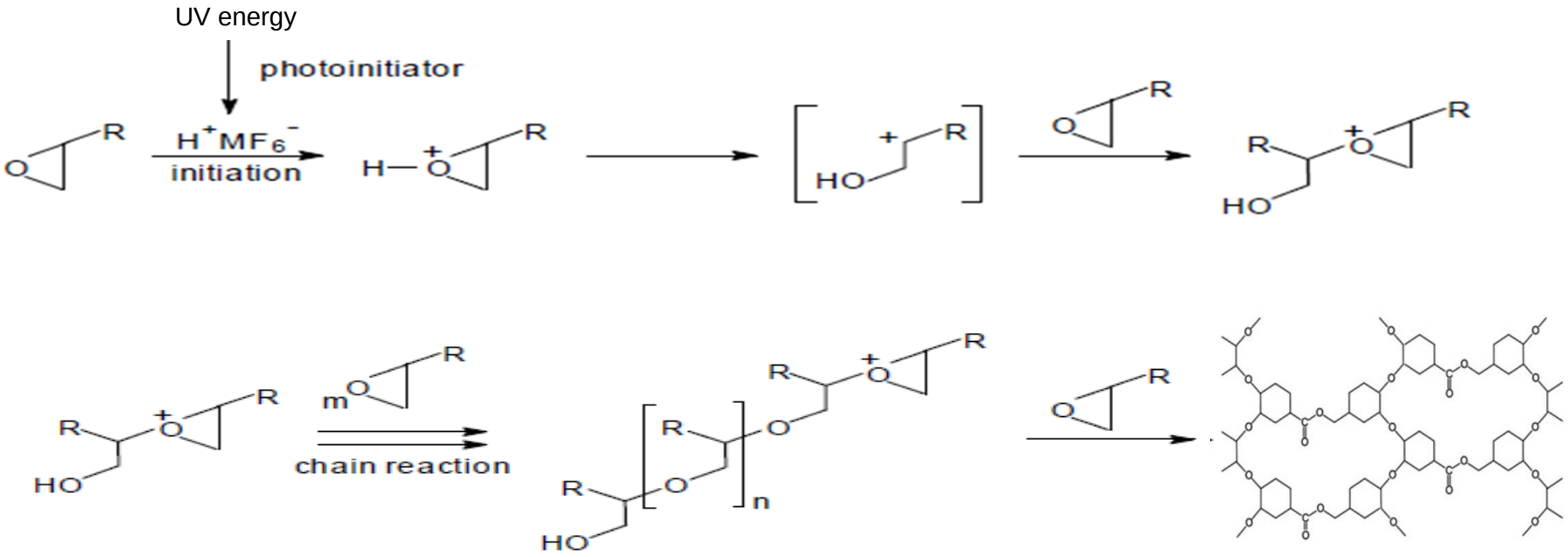




Key Take Away: cured quickly but not shadow curable

Cationic Polymerization

Once a cationic photointiators absorbs UV radiation the initiator molecules is converted into cation, that initiates polymerization.



Key Take Away: cationic adhesives continue curing after UV light is turned off (shadow cur effect).

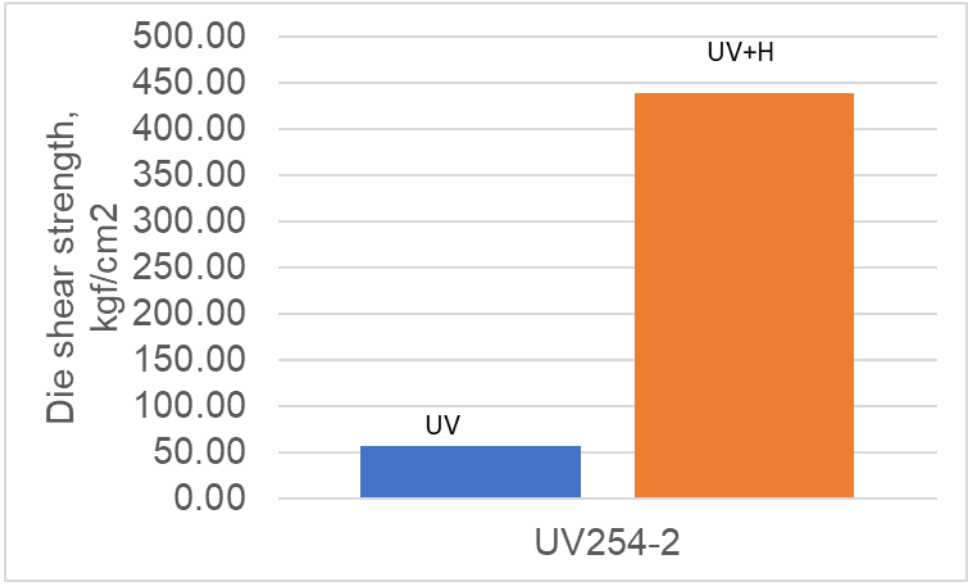
PART A3

UV + HEAT CURABLE ADHESIVE

Thermal Post Cure

The adhesive is thermally post-cured after UV irradiation

- To shorten time needed for cationic curing
- To increase molecules kinetic mobility through higher temperature
- To induce higher degree of cross-linking
- To improve mechanical and physical properties of the adhesive
- To cure area of adhesive that were not or less exposed to UV irradiation during processing (shadow areas)



PART B

Introducing Shadow Curable UV Adhesive

Shadow Curable UV Adhesive

For productivity reasons

- prefer light-curing adhesives to achieve high productivity levels.
- provide high positioning accuracy (initially fixed on demand).

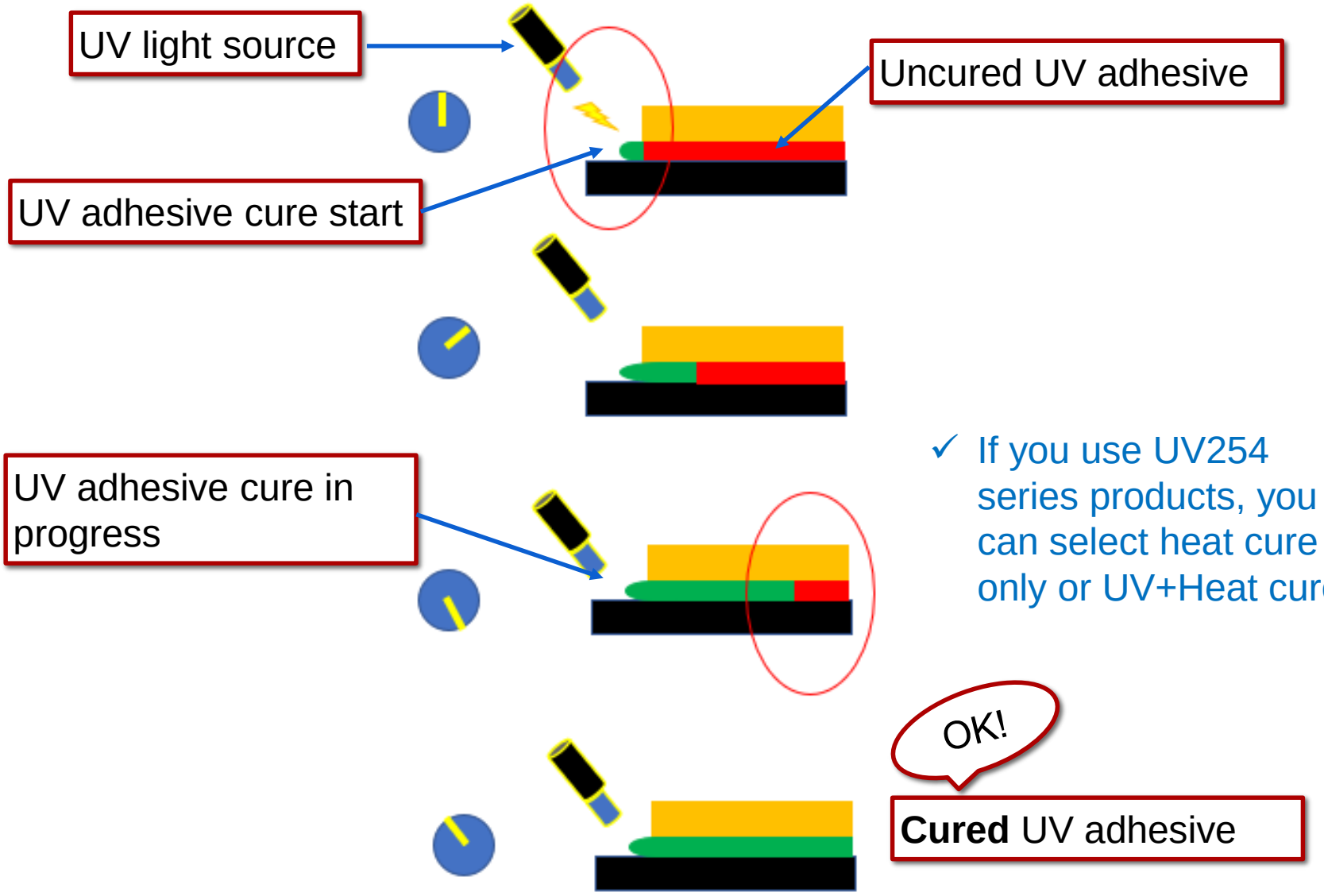
UV adhesive are subject to limitations.

- UV adhesive can be cured in seconds if fully exposed under high intensity UVA light source, but the challenge is always the shadowed areas.
- Many of today design with PEI, Nickel, Kovar, Gold, Alumina, Aluminum, Standard Steel, Silicon are not UV light penetrable.

Dual-curing products which able to resolve the UV shadow cure issue.

- offer the benefits of light-curing systems even under a UV shadow cure condition will not compromise on reliability, bond strength, and processing quality.
- Aside from light, a second heat curing mechanism is used so that adhesives can bond reliably and complete the cross-link, even in shadowed areas.

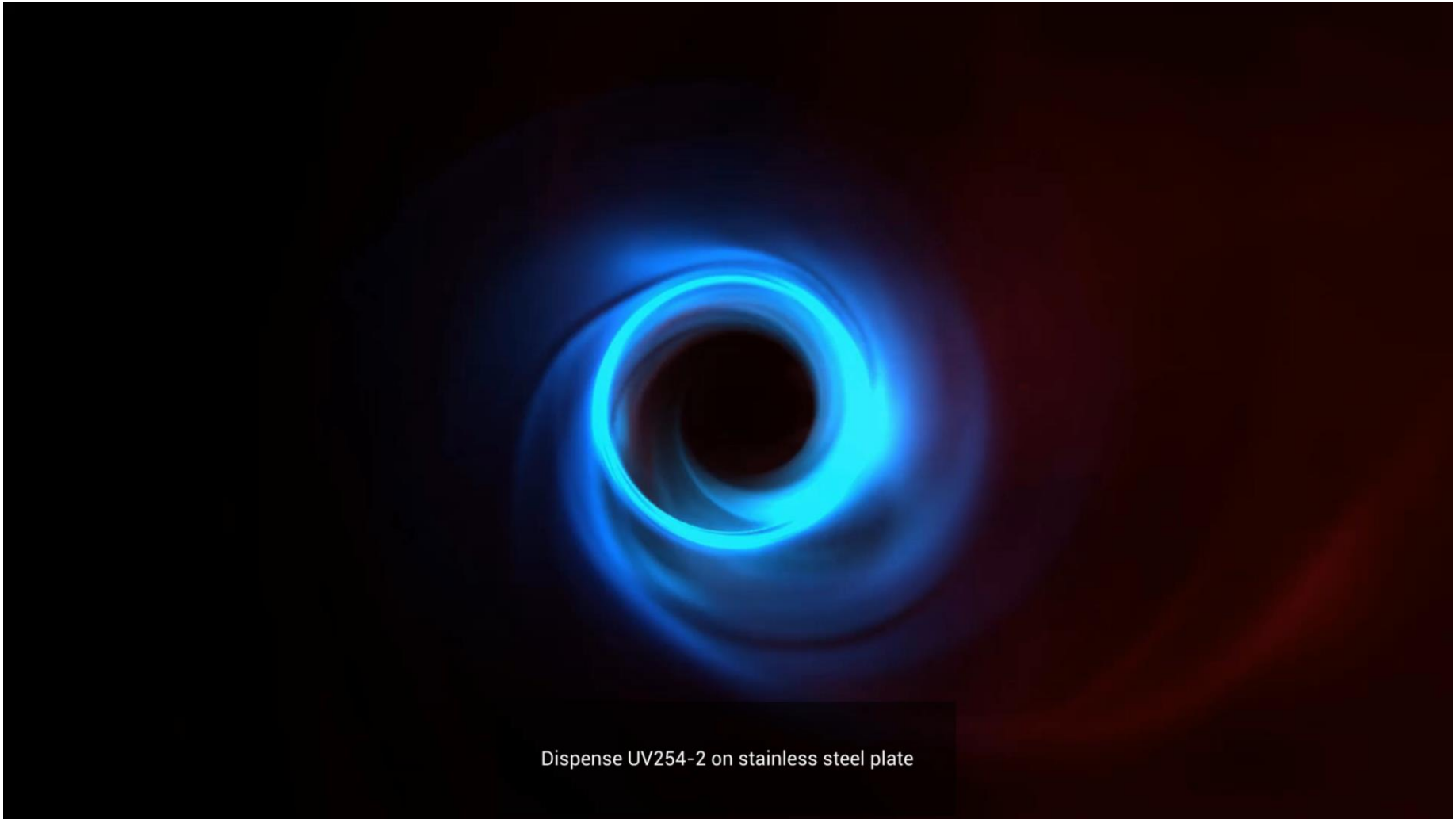
Concept of Shadow Cure



- ✓ If you use UV254 series products, you can select heat cure only or UV+Heat cure

Special Features

- UV254 series is UV or/ and heat curable epoxy system.
- Glass, Nickel, Ultem to metal substrates.
- Viscous adhesive.
- Heat curable without UV.
- Relatively moderate CTE.
- Dual cure (UV/heat curable) systems.
- Comply to RoHS and REACH requirements.


Dispense UV254-2 on stainless steel plate

Product selection guide

PENCHEM®

Parameter	Unit	UV739-1	UV254	UV254-1	UV254-2
Pot life at 25°C	Hours	72	72	56	33
Curing Profile	-	Pre-curing condition Wavelength 365nm Intensity: 2W/cm2 for 30s Post curing condition Optimum 125°C for 1 hour	Pre-curing condition Wavelength 365nm Intensity: 2W/cm2 for 15s Post curing condition 100°C or above for 1 hour	Pre-curing condition Wavelength 365nm Intensity: 2W/cm2 for 15s Post curing condition Min 80°C for 2 hours Optimum 120°C for 1 hour	Pre-curing condition Wavelength 365nm Intensity: 2W/cm2 for 15s Post curing condition Min 80°C for 2 hours Optimum 110°C for 1 hour
Chemical Type	-	Epoxy	Epoxy	Epoxy	Epoxy
Color & Appearance	-	Off white	Transparent clear	Translucent white	Translucent white
90° incline flow test, 25°C, 10 mins	mm	Slight-flowable	Flowable	Non-flowable	40
Viscosity @ 25°C	cP	70,500	481	7,913	14,620
Refractive index, 589 nm	-	NA	1.51	NA	NA
Coefficient Thermal Expansion, CTE1	ppm/K	33	59	38	21
Glass Transition Temperature	°C	159	165	111	96
Die shear strength Nickel to glass UV + Heat Cure	Kgf/cm²	65 (SS) 271 (Alumina)	57	105	45
Die shear strength_ Nickel to glass Heat Cure Only	Kgf/cm²	68 (SS) 161 (Alumina)	59	48	57

UV257-2 UV Pressure Sensitive Adhesive

Description

- UV257-2 is an epoxy based UV curable pressure sensitive adhesive.
- The epoxy has the capability to provide a tacky surface after UV irradiation and application of pressure may further enhance the adhesion properties.

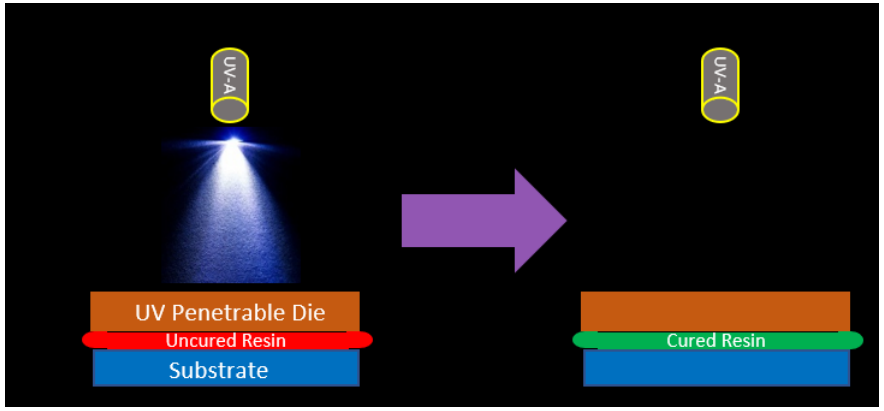
Features

- Good adhesion properties.
- Capable to join opaque parts together.
- Can be molded into desired shape.

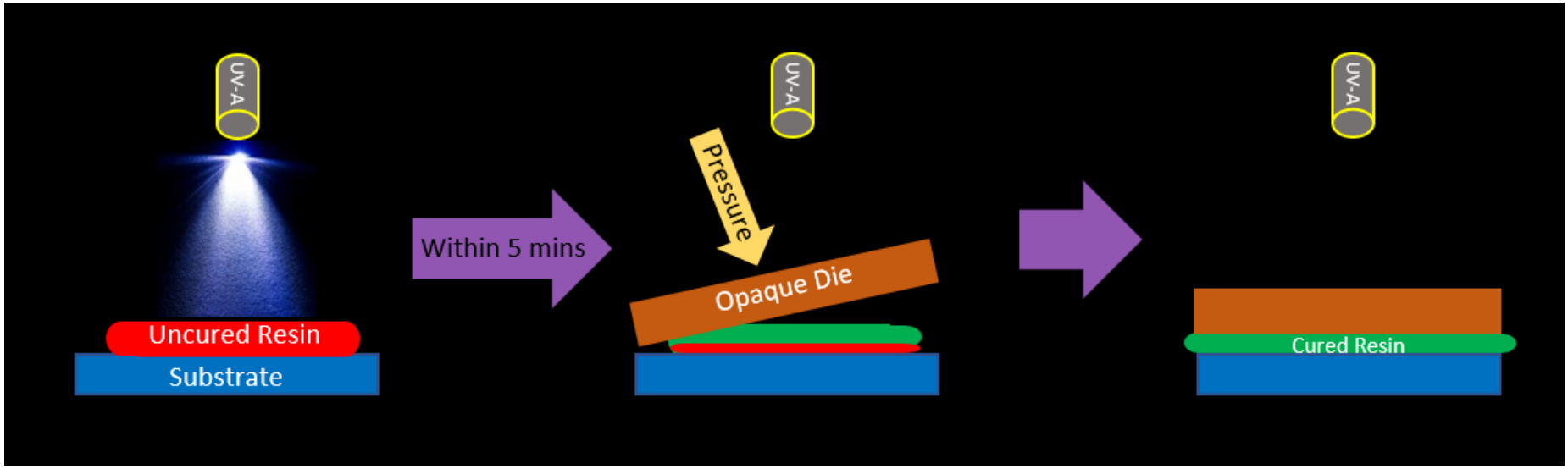
Application

PENCHEM®

- UV curable adhesives for structural application (glass and metal substrates).



- Suitable to be used as pressure sensitive adhesive application.



Product selection guide

Telecommunication Fiber Optic

Heat Cure Curable	UV + Heat Curable	Heat Curable EMI Shielding	Silver Die Attach	Flexible Die Attach
EN 418-2 GL 158 GL 168 EN 893-2	UV 566-20 UV 788-2	EM 120-1	AG 803 AG 824	PT 605-9

Q & A Session

THANK YOU!

For more information, please contact our technical and commercial team, who will be always pleased to help.

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