Shadow Cure UV Adhesive

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

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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

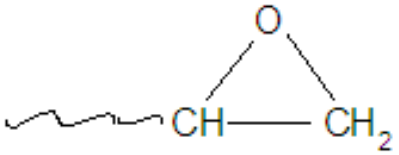
- ✓ Part B: Introducing Shadow Cure UV Adhesive
- ❖ Concept of shadow cure
- ❖ Product selection

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

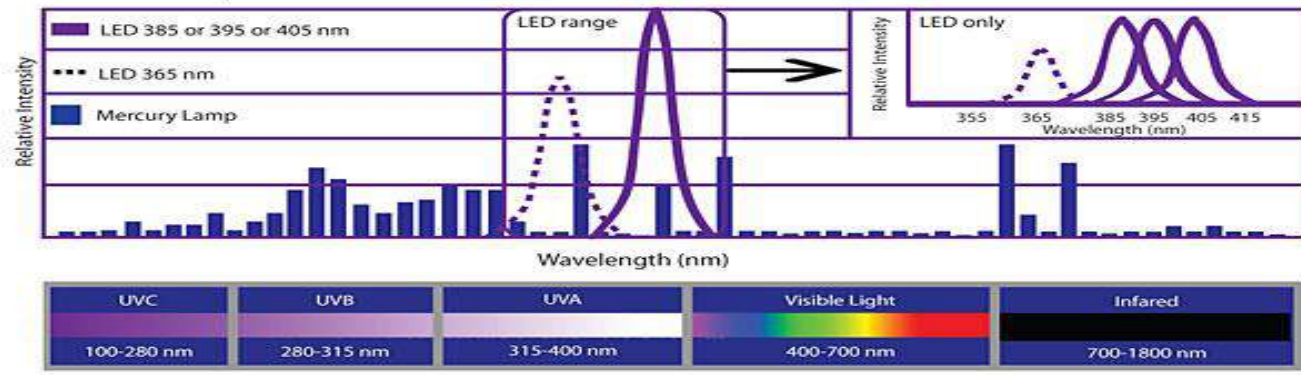
- Instant bonding (snap cure)
- component can be positioned precisely before adhesive harden→Production speeds and capacity are much faster
- Low viscosity light curing adhesives without the use of solvent
- Minimal emissions; ensuring a safer work place

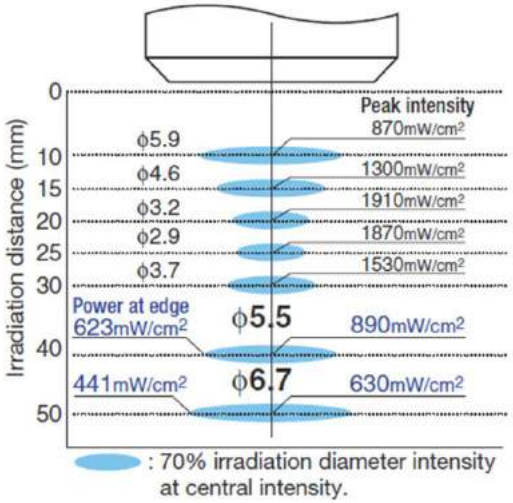
Light Curing Process

Factors affect the cure performances of UV adhesives:

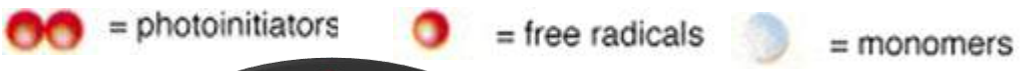
- Type of light sources: mercury arc lamp (broad wavelength) vs UV-LED (narrow wavelength)
- Sport cure (small area) vs conveyor cure (large area)
- Light Intensity (Not recommended to use very low intensity for extended times)
- Fix the distance between the light source and the adhesive
- Light transmission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

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





Free Radical Polymerization



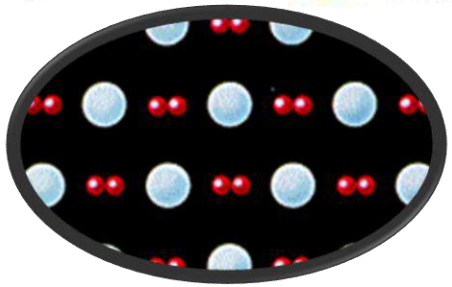
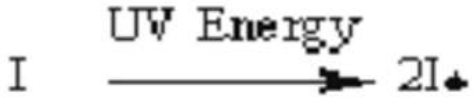


Figure 1: Monomers and photoinitators coexist without reacting with each other



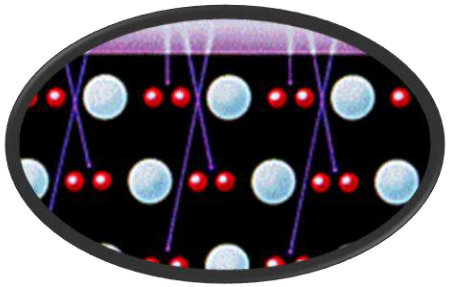


Figure 2: When expose to UV light, PI turn into free radicals.

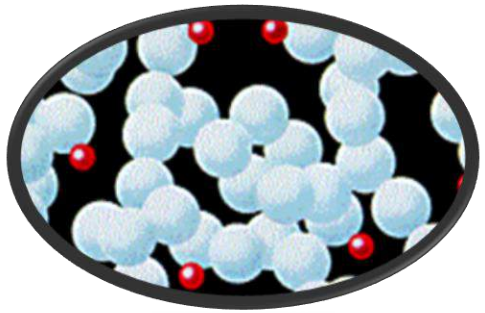


Figure 4: Cross-linked polymer chains in their cured state.

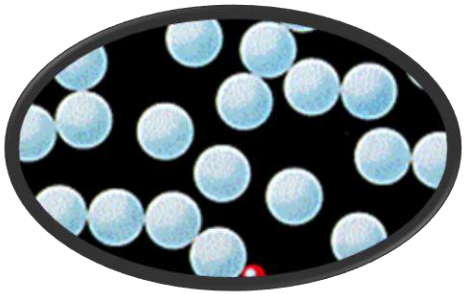
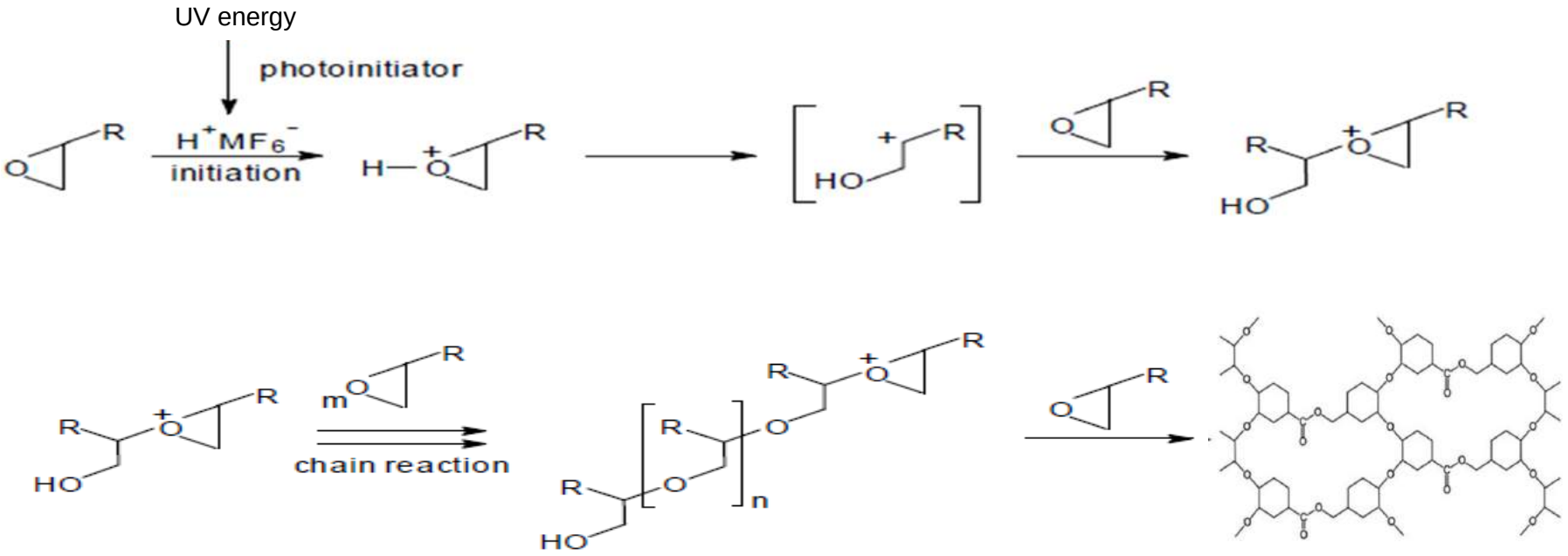


Figure 3: Free radicals initiate the Formation of monomer chains

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).

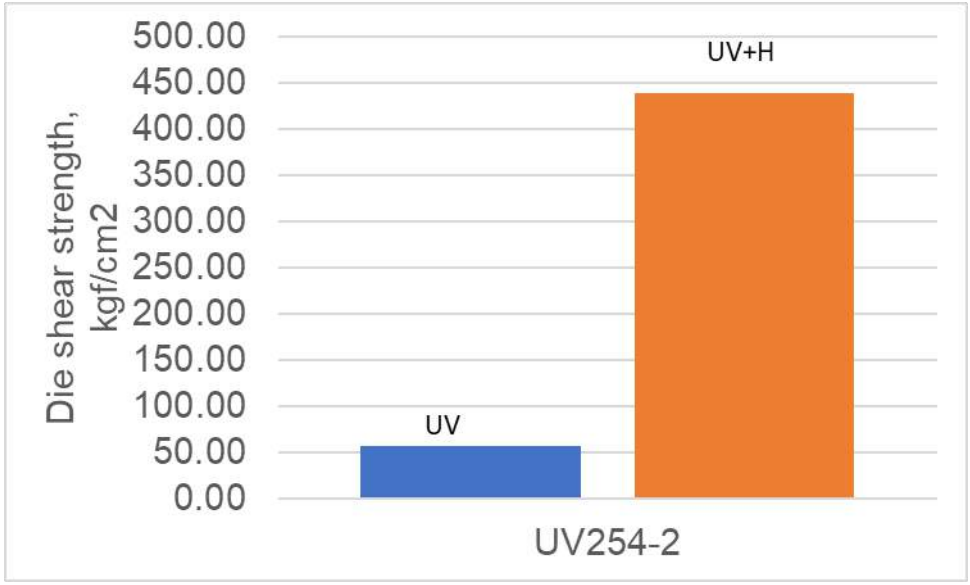
PART A3

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).

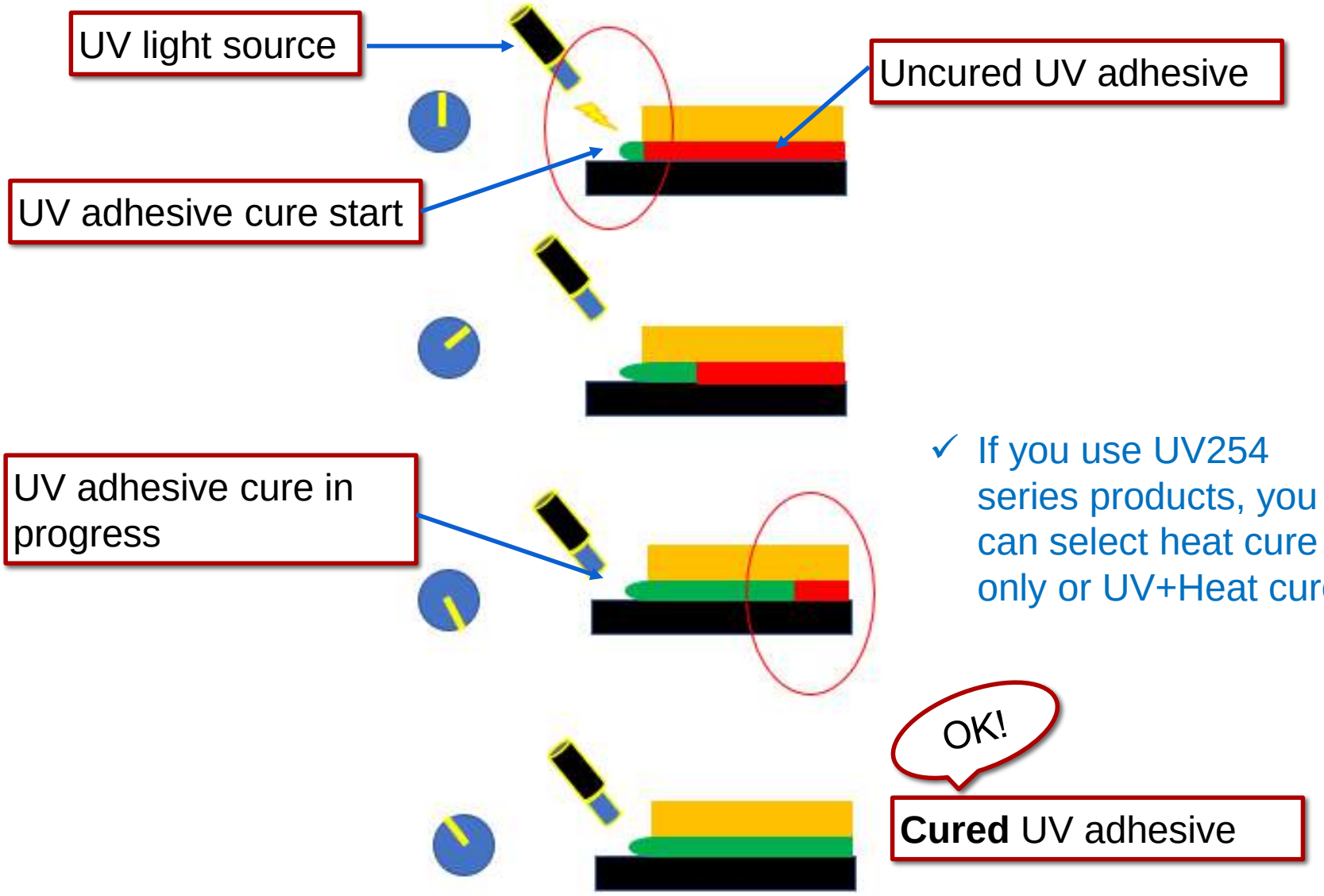
UV adhesive are subject to limitations.

- 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.

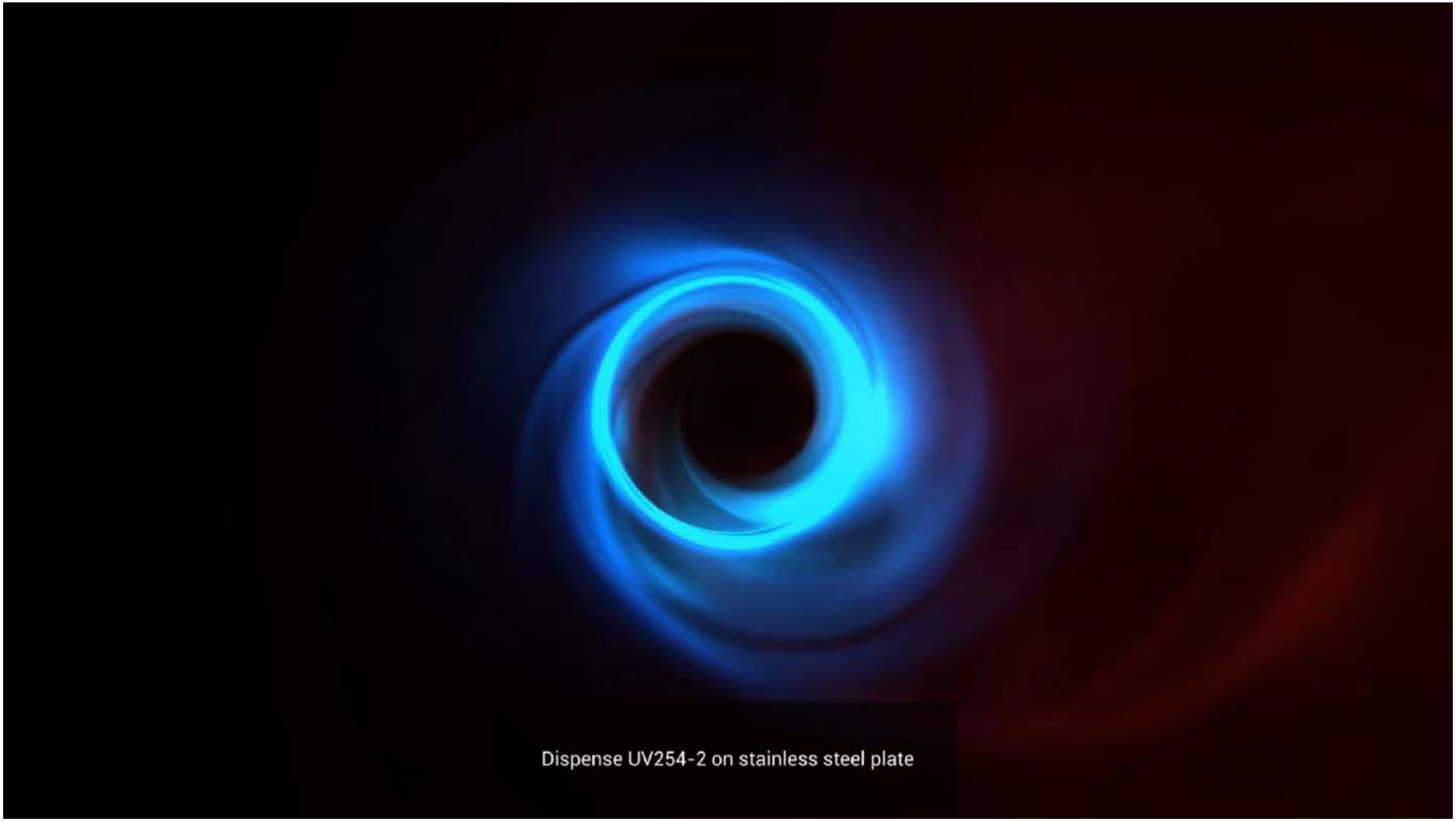
Concept of Shadow Cure



- ✓ 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

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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

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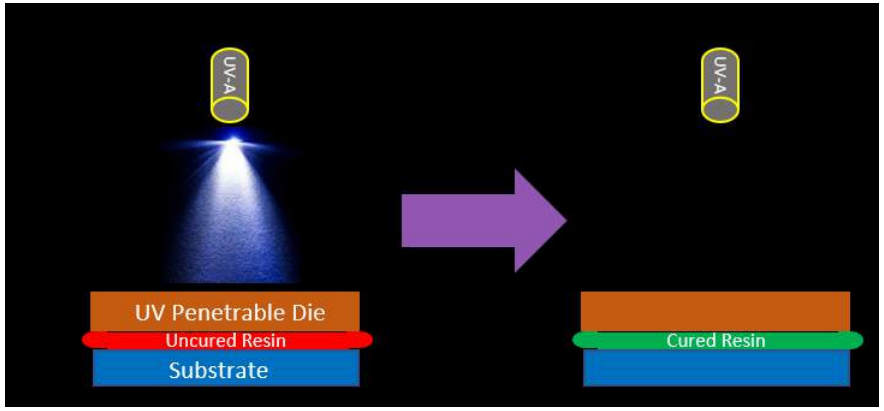
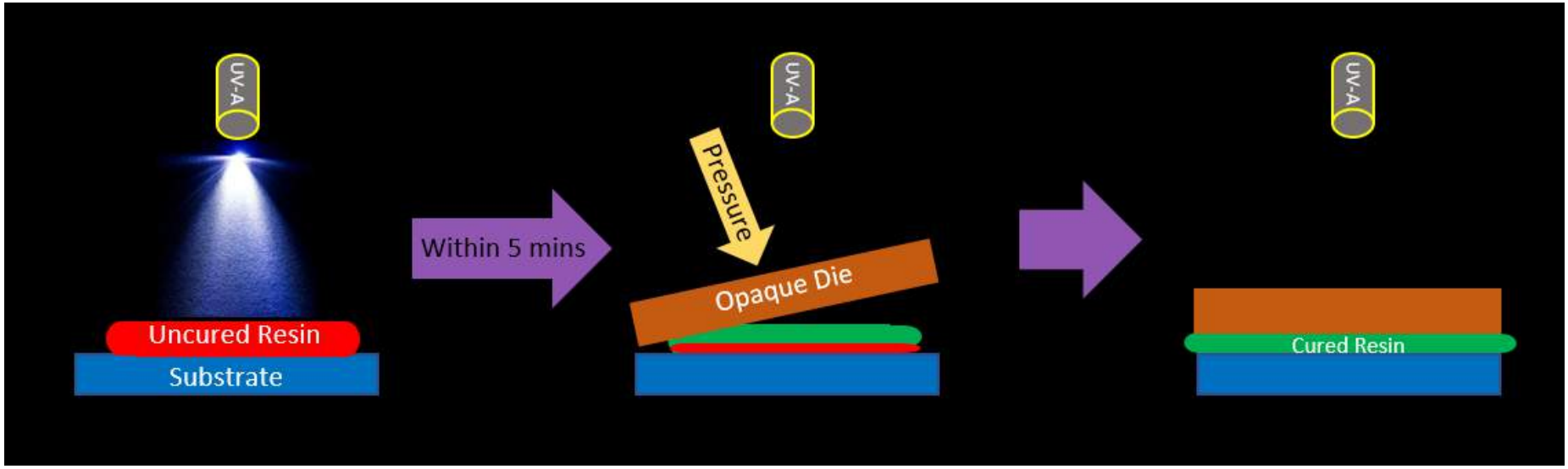
- UV curable adhesives for structural application (glass and metal substrates).



- Suitable to be used as pressure sensitive adhesive application.



Product selection guide

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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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