

The logo for PENCHEM, featuring the word "PENCHEM" in a bold, red, sans-serif font with a registered trademark symbol (®) at the end. The background of the slide is a photograph of a modern, multi-story office building with a white facade and large glass windows. The word "PENCHEM" is also visible in red letters on the side of the building's upper floor.

PENCHEM®

5G & 6G Optical Communication Webinar

**Advanced
Heat Curable Adhesives
Chemistry**

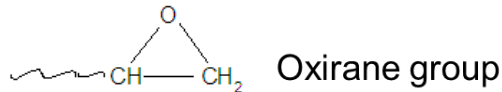
PART A1

HEAT CURABLE EPOXY ADHESIVE CHEMISTRY

EPOXY RESINS

What are Epoxy resins?

- A family of thermoset resins which have the following chemical group (oxirane):



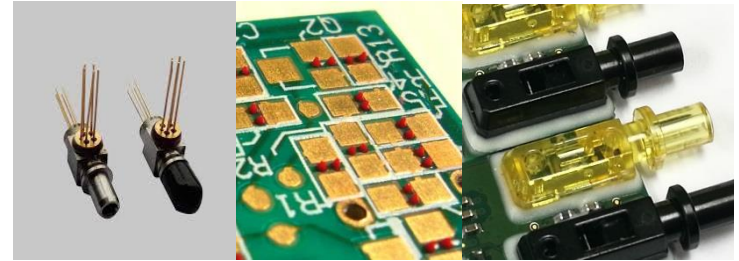
- When it reacted with a hardener (or curing agent), they set to a hard mass which does not melt or dissolve in solvents.
- One part epoxy adhesive require a latent curing agents or cationic thermal initiator, which it does not react with epoxy resin at or below room temperature, but will react with epoxy resin at elevated temperature.
- Type of epoxy curing agents:
 - Dicyanodiamide (DICY)
 - Amine
 - Imidazole
 - Anhydride
 - Cationic thermal initiator

- Structural bonding and Encapsulation



Product	Viscosity cPs@25°C	Hardness	Tg °C	Linear Shrinkage (%)	Special Feature
GL616	25,000	D85	122	1.51	Heat curable structural adhesive, white color, high adhesion strength, suitable for bonding of lens to PCB. Room temperature stable 1-part adhesive for 260days. Curable at 100-150C. Fulfill UBDH 1000hrs.
EN525	30,820	D90	152	1.45	Heat curable encapsulation epoxy, black color, Glob Height 1.5mm , high adhesion strength, suitable for bonding of lens to PCB. Curable at 100-150C and fulfill UBDH 1000hrs.
EN485	52,000	D85	140	1.32	Heat curable encapsulation epoxy, black color, Glob Height 2.0mm , high adhesion strength to gold, Nickel, Kovar, PCB, low CTE and low shrinkage. Curable at 100-150C and fulfill UBDH 1000hrs.

- Structural bonding and Sealant



Product	Viscosity cPs@25°C	Hardness	Tg °C	Linear Shrinkage (%)	Special Feature
GL614-4	42,000	D83	121	1.51	Heat curable structural adhesive, white color, high adhesion strength, suitable for bonding of metals and PCB. Fulfill UBDH 2000hrs. Snap curable within 5mins at 160C, 100C/1hr.
GL187-1	80,000	D80	92	1.35	Heat curable structural adhesive, red color, high adhesion strength on metal, glass and PCB. Snap curable within 100C/1.5mins
CB603-2	40,550	D86	118	1.3	Heat curable structural adhesive, red color, high adhesion strength, suitable for bonding of lens, ABS, Aluminum to PCB. Fulfill UBDH 1000hrs. Low temperature curable at 80C/40mins. Also suitable for chip bonding application.

- Gap Filling epoxy

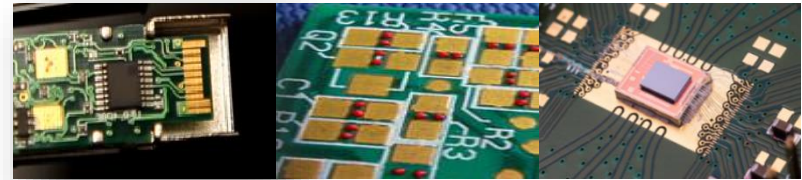
Product	Viscosity cPs@25°C	Hardness	Tg, °C	Color	Special Feature
PT328-1	450	D71		Clear	Curable from RT to 100C/2hrs with high transmission >98% from 980nm to 1600nm. High adhesion strength to ceramic and glass.
PT319-2	5,600	D65		Clear	Curable from RT to 60C/1hr, 100C/30mins. High bonding strength to metal, PCB and various plastics.
PT490-3	1,050	D82		Clear	Curable from RT to 60C/1hr, 100C/30mins High bonding strength to metal, PCB and various plastics. Available in black color also.
PT605-9	970	A66		Clear	Curable from RT to 135C/1.5hr. Highly flexible for metals, gold, glass and ultem bonding.



• Structural and Gap Filling Epoxy

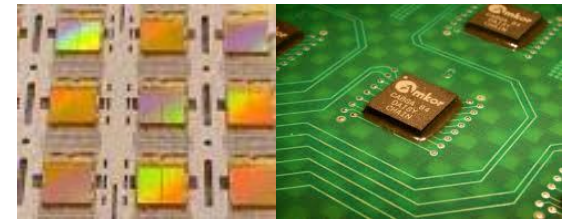
Product	Viscosity cPs@25°C	Hardness	Tg °C	Linear Shrinkage (%)	Special Feature
GL168	45,085	D85	123	1.55	Heat curable structural adhesive, white color, high adhesion strength, suitable for bonding of lens to PCB . Fulfill UBDH 2000hrs.
GL158	35,000	D85	119	1.52	Heat curable structural adhesive, white color, high adhesion strength, suitable for bonding of lens to PCB . Fulfill UBDH 2000hrs.
TH737-1	154,870	D94	132	1.06	Thermally conductive adhesive at 2.6W/mk. Heat curable structural adhesive, white color, high adhesion strength to gold, Nickel, Kovar, PCB, low CTE and low shrinkage. Fulfill UBDH 2000hrs.
TH737-6	159,900	D91	123	1.1	Thermally conductive adhesive at 2.3W/mk. Heat curable structural adhesive, white color, high adhesion strength to gold, Nickel, Kovar, PCB, low CTE and low shrinkage. Fulfill UBDH 2000hrs.
EN418-2	21,000	D88	136	0.66	Heat curable structural adhesive, black color, high adhesion strength to Gold , Nickel, Kovar, PCB, low CTE and low shrinkage. Curable at 85°C-120°C/1-2hrs. Fulfill UBDH 2000hrs.
EN418-12	9,850	D86	122	0.68	Heat curable structural adhesive, black color, high adhesion strength to Gold , Nickel, Kovar, PCB, low CTE and low shrinkage. Curable at 85°C-120°C/1-2hrs. Fulfill UBDH 2000hrs.
EN418-17	56,462	D90	118	0.61	EN418-12 with additional feature on bondline thickness at 250um.

- Silver Conductive Epoxy



Product	Viscosity cPs@25°C	Hardness	Special Feature
AG824	7,000	D77	Low viscosity Silver epoxy, high Tg, high adhesion and low volume resistivity. Fulfill UBDH 2000hrs.
AG824-1	11,348	D77	AG824 with control of bondline thickness at 50um.
AG829-1	6,325	-	Spray-able silver EMI shielding coating. Low viscosity Silver conductive epoxy, and low volume resistivity. Fulfill UBDH 1000hrs.
AG815	9,300	D81	2 parts heat curable silver epoxy at 87C/1hr, high Tg, low viscosity and high adhesion strength. Fulfilled UBDH 2000hrs

- Underfill and Die Attach



Product	Viscosity cPs@25°C	Hardness	Tg °C	Linear Shrinkage (%)	Special Feature
DA669	45,085	D85	123	1.55	Flexible die attach. Heat curable structural adhesive, black color, good adhesion strength, suitable for bonding of flexible die attach. Fulfill UBDH 1000hrs.
DA669-4	6,500	D84	117	1.20	Heat curable jetting Die Attach Adhesive, black color, high adhesion strength, suitable for bonding of dam on PCB and die attach for microelectronic semiconductor chips. Fulfill UBDH 1000hrs.
UF253-1	1200	D88	128	0.98	Low CTE at 31ppm/k underfill. Heat curable structural adhesive, black color, high adhesion strength to gold, Nickel, Kovar, PCB, low CTE and low shrinkage. Fulfill UBDH 2000hrs. Snap curable at 150C/5mins

PART A2

HEAT CURABLE SILICONE ADHESIVE

Crosslinking reaction of silicones

During crosslinking reaction, the individual silicone polymer chains are linked together to form one giant molecule.

Silicones can be crosslinked via:

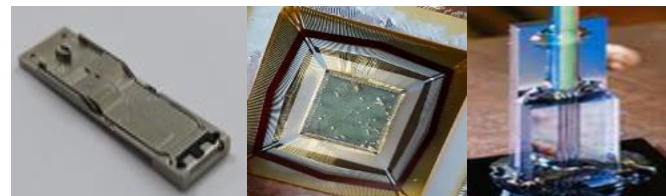
- 1) **Addition cure**
- 2) Condensation cure
- 3) Free radical polymerization

Example of substances will inhibit addition cure silicone system

Addition cure system is sensitive to:

- **Sulfur containing compounds** (mercaptans, sulfates, sulfides, sulfites, thiols and rubbers vulcanized with sulfur will inhibit contacting surfaces)
- **Nitrogen containing compounds** (amides, amines-epoxy, imides, nitriles)
- **Tin containing compounds** (tin catalysed condensation-cure silicones)
- **Moisture** (Working environment and Substrate)
- **Phosphate compounds** (eg, Triphenylphosphate (plasticizer / fire retardant))

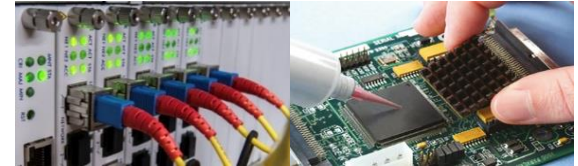
- Silicone Gasket, gap filling, gold wire production



Product	Viscosity cPs@25°C	Hardness	Tg °C	RI 589nm	Special Feature
EM 120-1	5,000,000	A40	-	-	80dm shielding for up-to 400G product application. Fulfill UBDH 2000hrs.
EM 120-2	2,000,000	A35-50	-	-	100dm shielding for up-to 800G and above product application. Fulfill UBDH 2000hrs.
OP993-13	3,942	gel	-97	1.429	Low RI heat Curable gap filler , ultra-low outgassing , Suitable for RI Matching and gap filling application. Fulfill UBDH 2000hrs
EN893-2	4,300	00 53	-98	1.429	Low RI Heat curable gold wire protection gap filler , ultra-low outgassing and fulfill UBDH 2000hrs

Thermal Management Material

- Thermal Pad and Thermal Putty



Product	Type	Hardness	Thermal Conductivity W/mK	Special Feature
Dispensable Thermal Putty				
TH280-1	Non-Silicone		4	Automatic Dispensable, medium thermal conductivity, low outgassing, ULV0 94 and ultra-low bleed. Fulfill UBDH2000hrs.
TH855-1	Silicone	-	7.5	Automatic Dispensable, high thermal conductivity, low outgassing, ULV0 94 and low bleed. Fulfill UBDH 2000hrs.
TH855-3	Silicone	-	7.5	Automatic Dispensable, high thermal conductivity, low outgassing, ULV0 94 and ultra-low bleed. Fulfill UBDH 2000hrs.
TH949-1	Silicone	-	11	Dispensable, high thermal conductivity, low outgassing, ULV0 94 and ultra-low bleed. Fulfill UBDH 2000hrs.
Non-electrical Conductive Thermal Pad				
TH221-3	Non- Silicone	40-50	1.5	Low thermal conductivity, low outgassing, UL 94 V0. Fulfill MSL 2000hrs.
TH223-1	Non- Silicone	60-70	7	Medium thermal conductivity, low outgassing, UL 94 V0. Fulfill MSL 2000hrs.
TH228	Non- Silicone	60-70	8	Medium thermal conductivity, low outgassing, UL 94 V0. Fulfill MSL 2000hrs.
TH226	Non- Silicone	80-90	12	Medium thermal conductivity, low outgassing, UL 94 V0. Fulfill MSL 2000hrs.
TH817	Silicone	80	17	Extreme high thermal conductivity, low outgassing, UL 94 V0. Fulfill MSL 2000hrs

THANK YOU!

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

PENCHEM[®]

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