

台俄科技移轉合作說明會
(Russian Academy of Energy Institute of
Knowledge-Intensive Engineering Technology)

強化工程及管件感光聚合物複合材料

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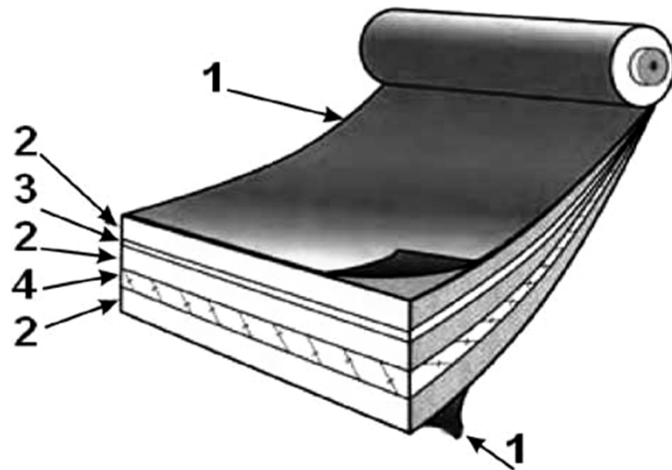


Russian Academy of Engineering Institute of Knowledge-Intensive Engineering Technologies

感光聚合物複合材料 (*photopolymer composites*)

光聚合物材料 «MATERIUM» 是可以形成事先預定屬性材料的複合材：抗腐蝕、耐化學腐蝕、電介質（絕緣體）及防火，可以來保護各種金屬、水泥、玻璃、木材、塑料及塑膠作的水管、容器及設備

材料應用於管線上，具有獨一無二的化學保護特性（對抗超過700種化學活性化合物），耐高溫達220°C、承受200ATM壓力。當施用於水泥結構時（包括浸水部位）可以增加50%的強度



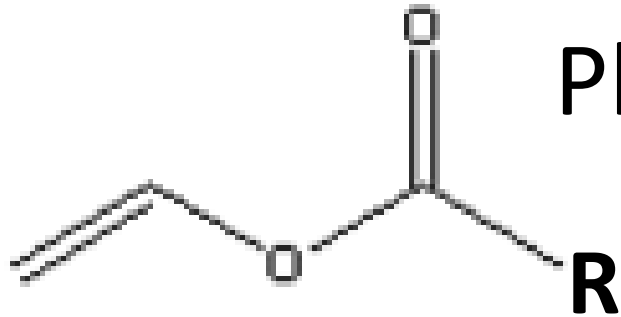
- 1 – 尼龍薄膜,
- 2 – 富含樹脂層
- 3 – C-type玻璃中間層
- 4 – E-type玻璃中間層

- 共同提案並進行科研計劃 (JSR)
- 規劃共同生產高科技產品 (JCT)

(1) Vinyl ester $\xrightarrow{\text{UV curing}}$ **Very difficult**

Initiator

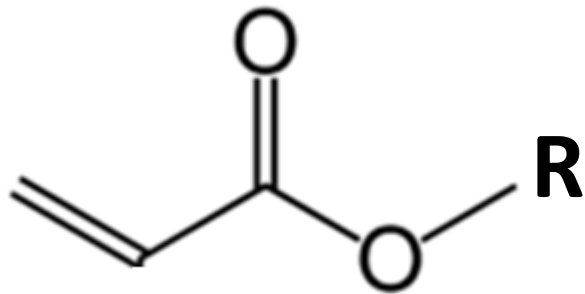
Photo initiator



(2) Acrylates $\xrightarrow{\text{UV curing}}$ **Easy**

Initiator

Photo initiator



Vinyl ester

(Russia side called)

Epoxy acrylate for UV
curing

Recipe

1. **Epoxy acrylate oligomer**
2. **Styrene monomer (as a reagent and diluent)**
3. **Fiber glass**

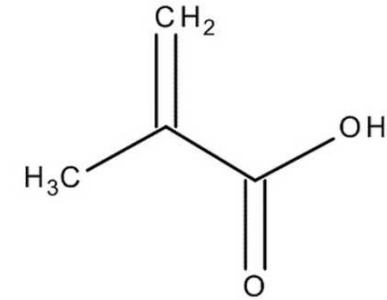


Photo initiator

**Fiber Reinforced Polymer/Plastic composite
(FRP)**



Methacrylic acid



Vinyl Ester resin is produced from the esterification of an epoxy resin with a methacrylic acid and the reacted product is then dissolved in styrene monomer. Vinyl ester resin has both advantages of unsaturated polyester resin and epoxy resin, including excellent corrosion resistance to most acids and alkali chemicals; more strength and mechanical properties; superior operability and environmental durability.

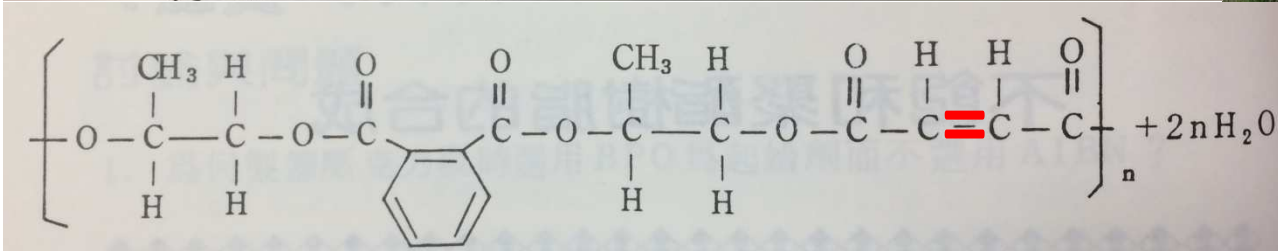
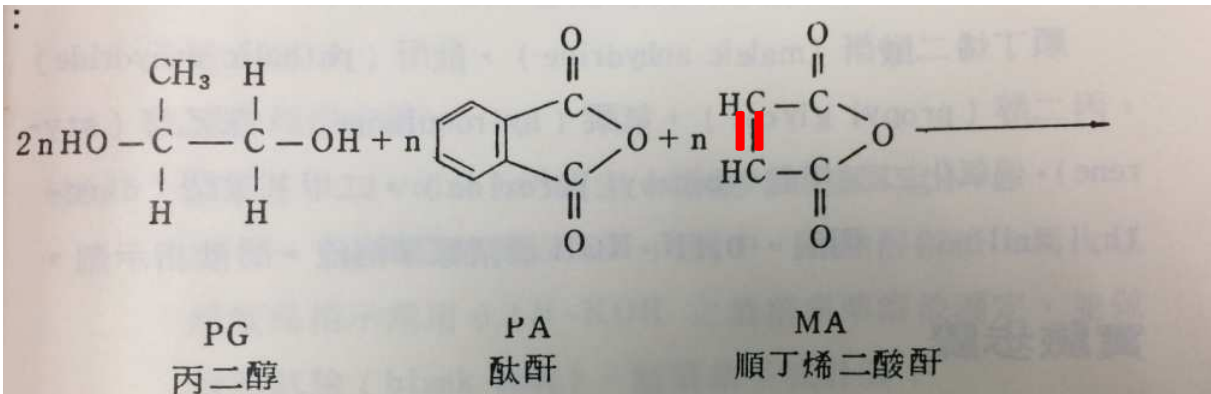
For thermo-setting resin



FRP游艇
热固型塑料

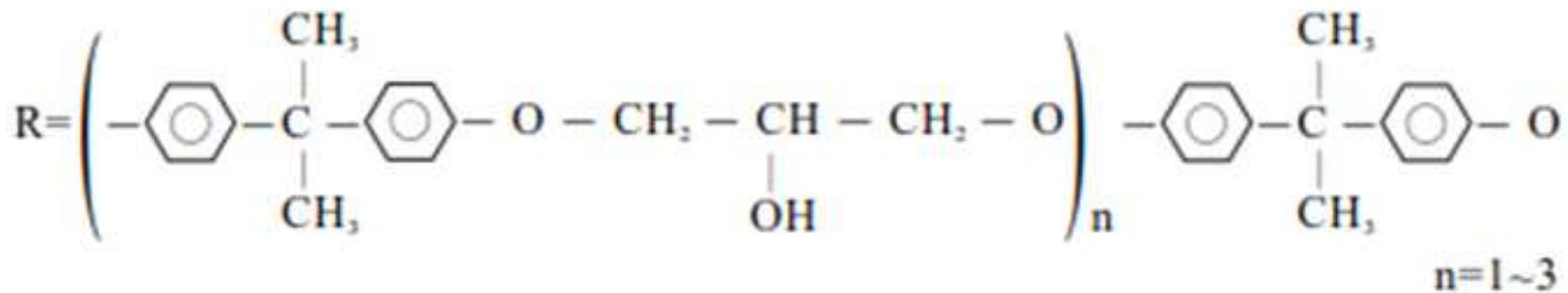
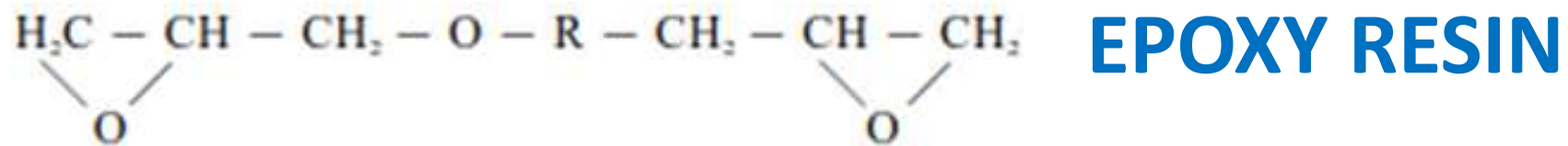
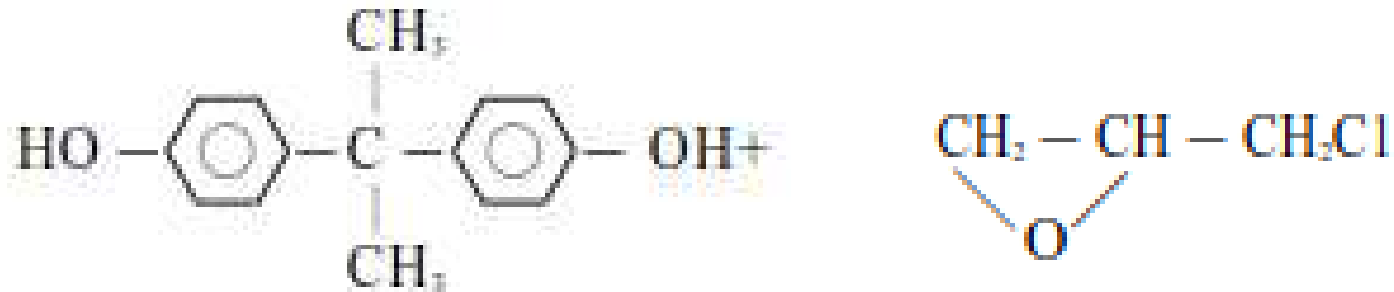
游艇

Unsaturated polyester

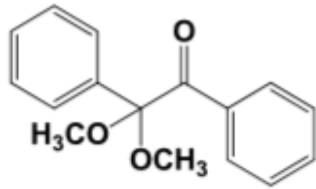


I 環氧壓克力樹脂 (Epoxy acrylate resin)

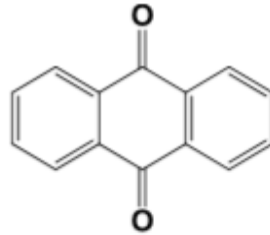
STEP 1



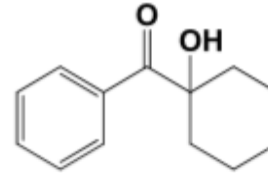
II 光起始劑 (Photoinitiator)



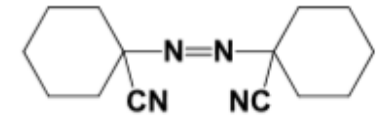
2,2-Dimethoxy-2-phenylacetophenone



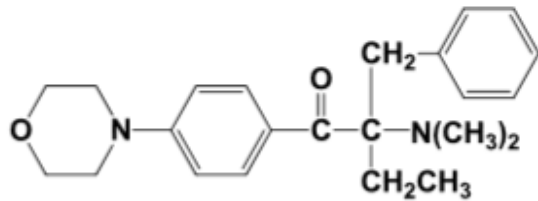
Anthraquinone



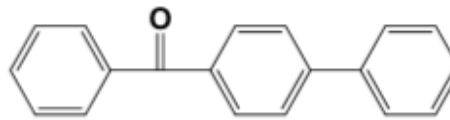
Irgacure 184



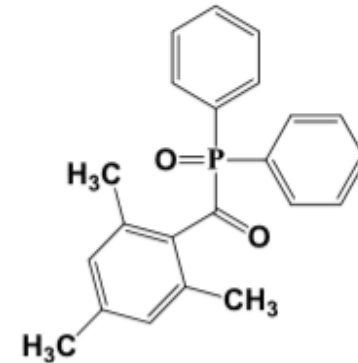
ABCN



2-Benzyl-2-(dimethylamino)-4'-
morpholinobutyrophenone



4-Benzoylbiphenyl

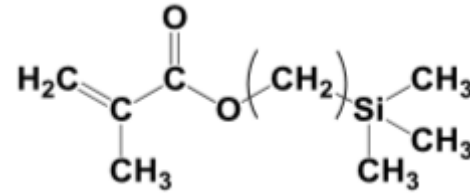


TPO

III 稀釋劑 (Diluent monomer):

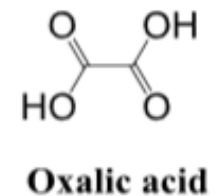
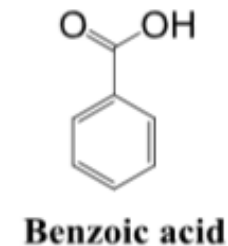
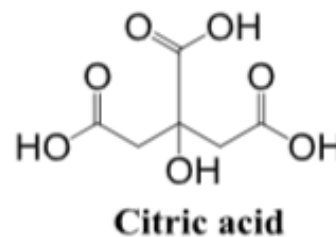
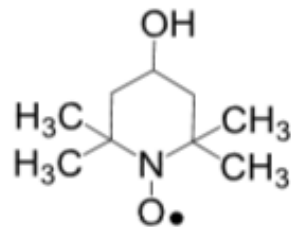
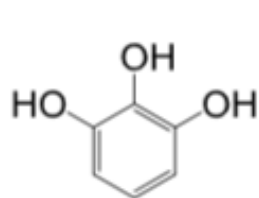
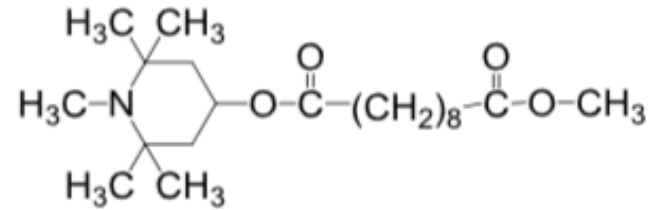
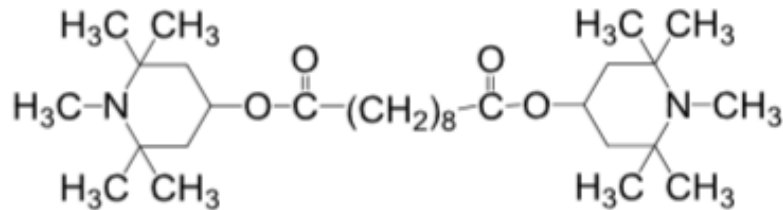
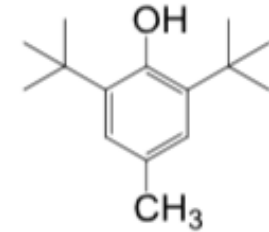
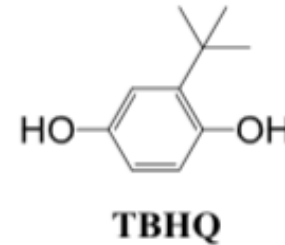
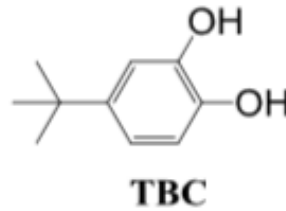
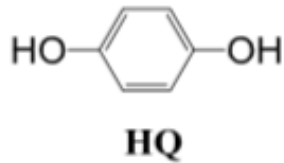
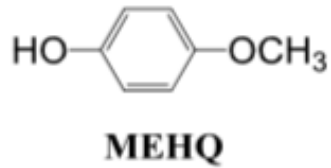
苯乙烯 (Styrene)

IV 密着促進劑:



对基板增加密着性

V 安定劑/抑制劑(Storage stabilizer/ Inhibitor)





Epoxy acrylate

Also known as Vinyl ester, these resins (which should not be confused with pure Epoxy – see below) offer improved properties compared to polyesters although they cure in the same way, and therefore show the same fast cure and good low temperature performance. Due to the different polymer they generally exhibit improved strength and importantly better chemical resistance. **Styrenated** and **styrene-free** versions of **epoxy-acrylates** are available and again, the styrene-free products have the advantage in terms of better health and safety classifications.

Use of epoxy vinyl ester resins (Epoxy acrylate)

The use of epoxy vinyl ester resins covers a broad range of industrial applications with an operating window of -40 to +200 C:

- Industrial / petrochemical
- Oil & gas
- Power plants
- Marine & offshore
- Utility

e.g. Fire water lines

Desalination (drinking water approved resin)

Industrial sewers

Use of epoxy vinyl ester resins (Epoxy acrylate)

Mechanical resistance
Thermal resistance



Similar to
epoxy resins

Viscosity
Handling
Cure



Similar to unsaturated
polyester (UP) resins

Chemical
resistance



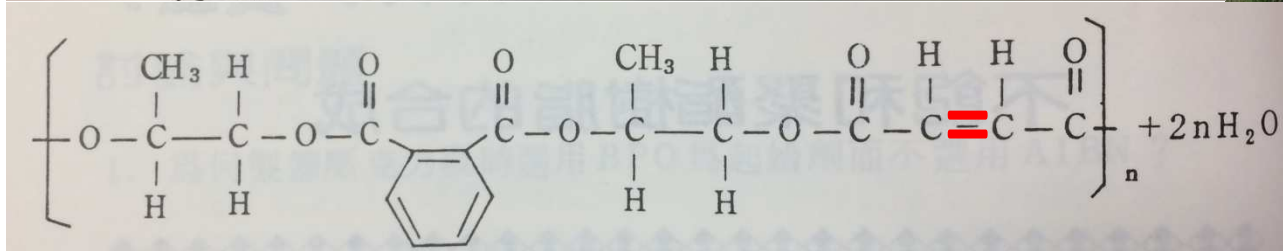
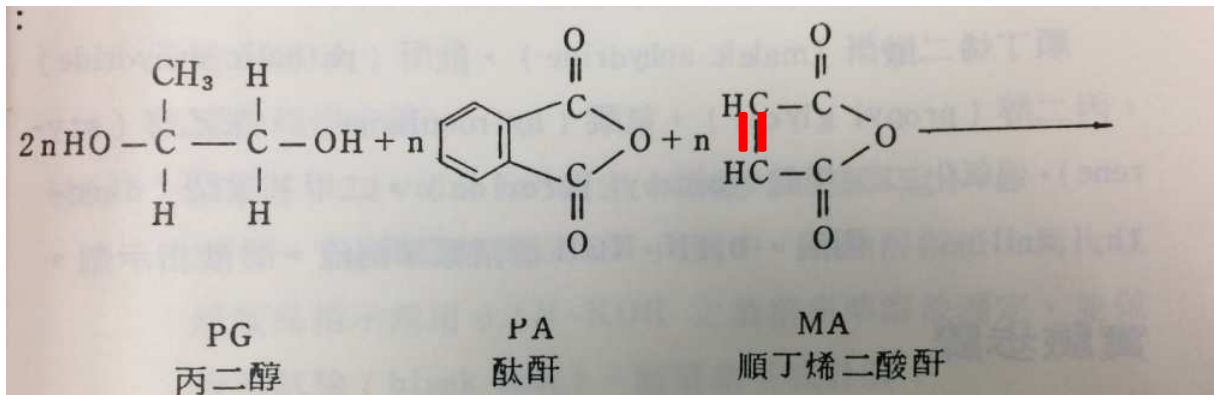
Better than epoxy
or UP resins



FRP游艇
热固型塑料

游艇

Unsaturated polyester



Case history



GERMANY

Blades for wind turbines made in DERA KANE 601 epoxy vinyl ester resin installed at diverse wind parks globally **(Epoxy acrylate)**

Case history (Tube lining)



Duct from flue gas scrubber to chimney made in DERAKANE 411 epoxy vinyl ester resin, installed in Germany

Thanks for your kind attention!