Production Technology And Application Of Glycidyl Methacrylate

Ted Tan +8613176033723

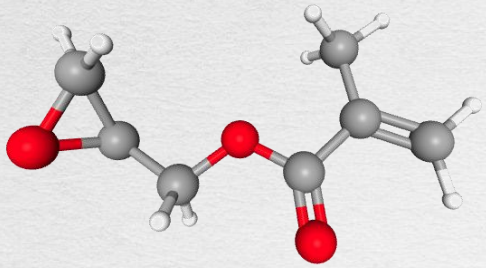
Weicheng Advanced Materials (Shandong) Co., Ltd.

WEI CHENG
玮成新材料 Advanced Material

1. Current GMA production Capacity

2. GMA Synthesis And Separation Process

3. GMA Applications



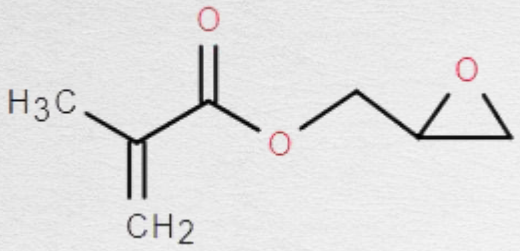
1. Current domestic GMA production capacity and output

Introduction to GMA monomer:

GMA is called glycidyl methacrylate in Chinese. It is a colorless transparent liquid with a molecular weight of 144.1, a boiling point of 189°C, a density of 1.073t/m³, a refractive index of 1.4494, a glass transition temperature of 46°C, and is almost insoluble in water.

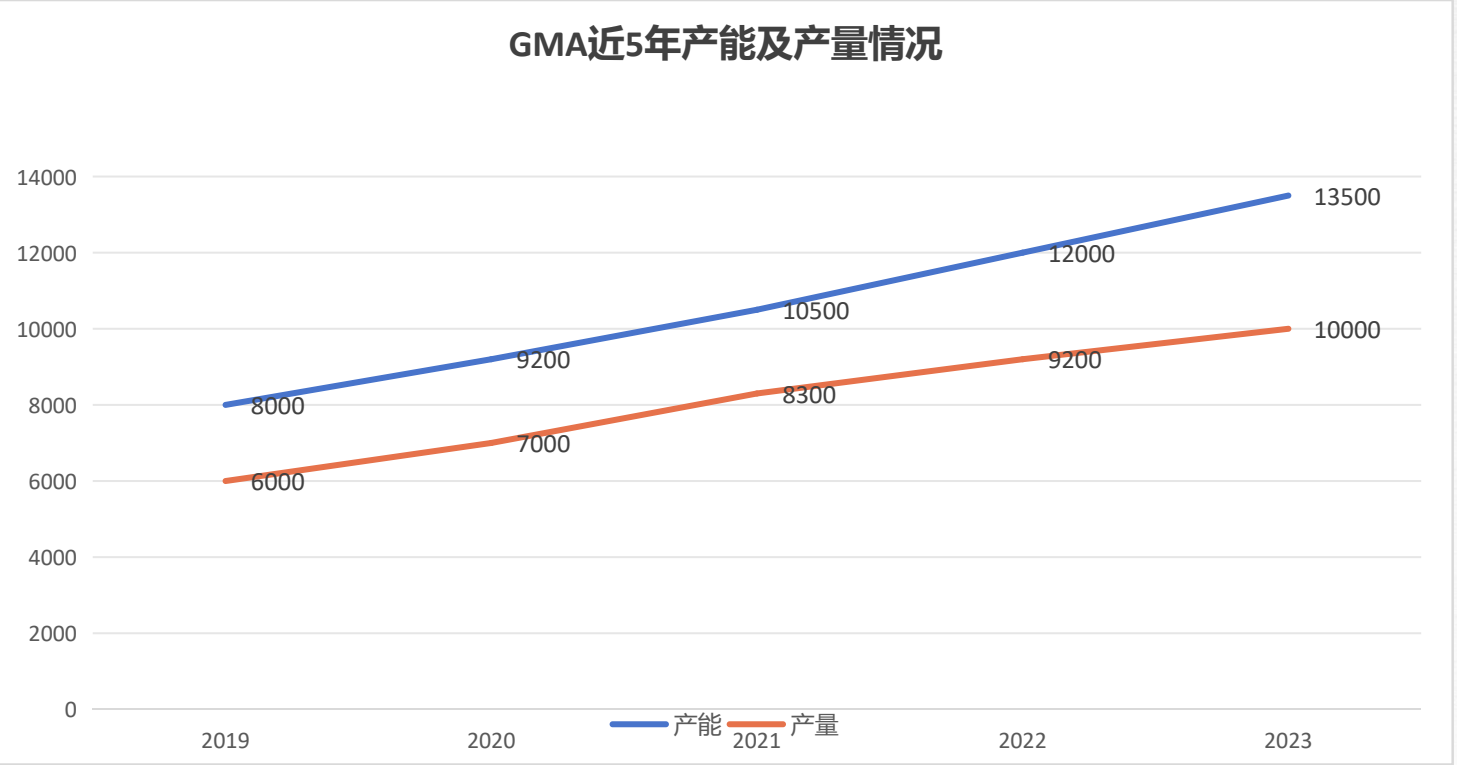
It is an acrylate monomer containing epoxy groups. The double bond of acrylate has a high reactivity and can undergo self-polymerization and copolymerization with many other monomers. The epoxy group can react with hydroxyl, amino, carboxyl or anhydride to introduce more functional groups, thereby bringing more functionality to the product. It can be

used in coating resins, adhesives, inks, medicines, plastic elastomers, acrylic rubber and other fields.



GMA production and capacity

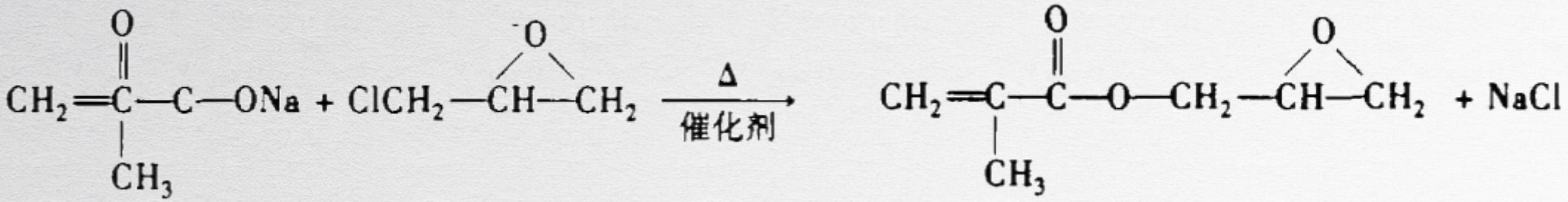
Weicheng New Materials (Shandong) Co., Ltd. is the largest GMA manufacturer in China. Major foreign companies include Dow, Mitsubishi Gas Chemical, etc.



2. GMA Synthesis Process

2-1. Epichlorohydrin Method:

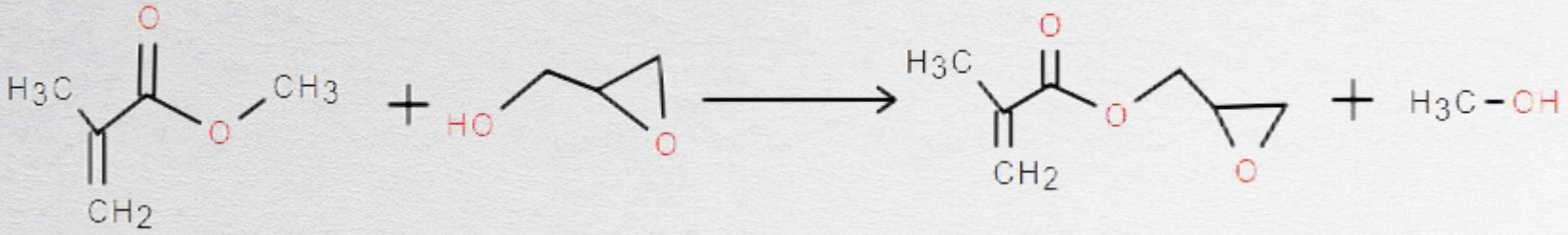
ECH one-step method: Epichlorohydrin and sodium methacrylate produce GMA under the action of phase transfer agent.



This synthesis method requires a large amount of ECH to be added, generally 5-6 times that of sodium salt. The excess ECH needs to be separated, recovered and reused, resulting in high energy consumption.

2-2. Glycidyl Ester Exchange Method

Methyl methacrylate and glycidol undergo ester exchange reaction to produce GMA and methanol.

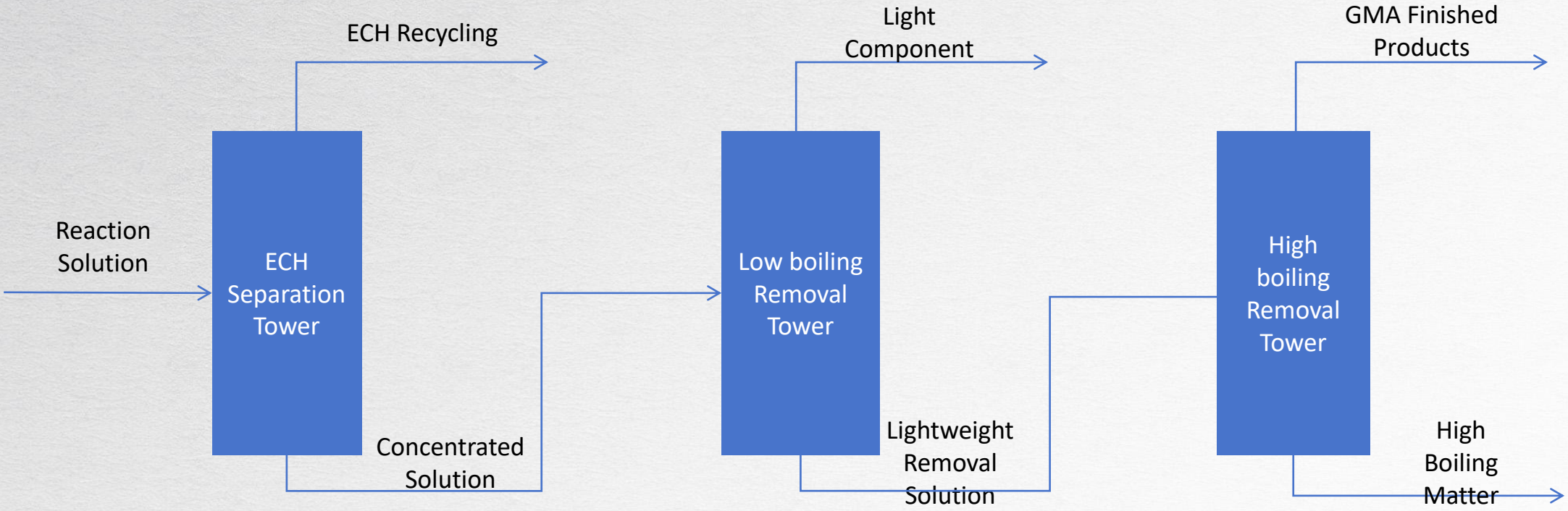


This process route does not use ECH and can produce chlorine-free GMA, which can be used in places with high requirements for chloride ions; but the product will contain formaldehyde and methanol.

However, the price of glycidol is high and the production cost is high. In addition, the dosage of methyl methacrylate is generally 2-3 times that of glycidol, and the excess MMA needs to be separated and recovered.

2-3. GMA separation and purification

The current mainstream synthesis process is the ECH method, which is mature and stable, with few by-products and high yield. Separation and purification are mainly divided into three steps: ECH separation and recovery, light removal, and high removal. The separation technology has basically achieved continuous operation, and some devices are still intermittent operation.

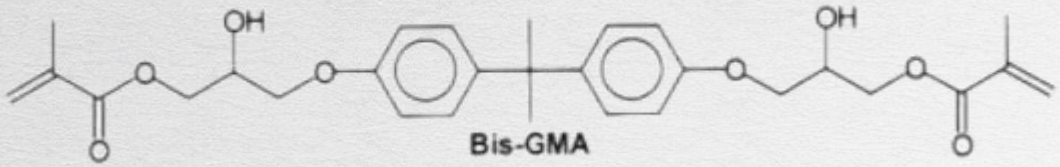


Weicheng New Materials (Shandong) Co., Ltd. strives for excellence, optimizes production processes, improves production equipment, and realizes continuous distillation production. The GMA impurity content is low and the purity exceeds 99.8%, which is the highest in the industry. The product performance is more stable and the application range is wider.

3. GMA Applications

3-1. Medical materials

Tooth repair agent, composed of bisphenol A-glycidyl methacrylate (BIS-GMA) and a certain proportion of functional monomer diluent, initiator and filler, is used to fill tooth cavities, etc.



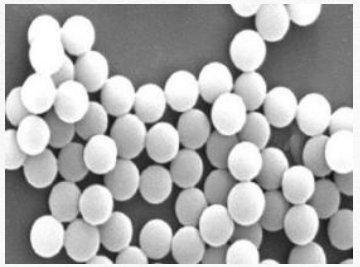
3-2. GMA magnetic microspheres

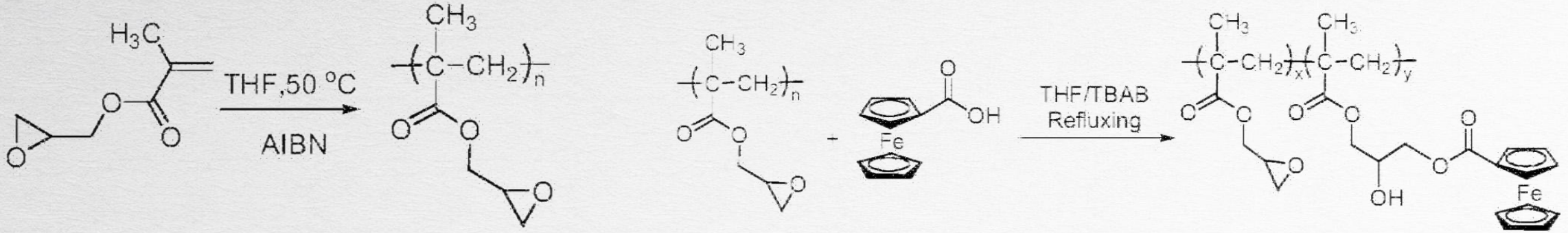
GMA is homopolymerized or copolymerized with monomers such as styrene to form nanoscale microspheres. It has a wide range of applications.

Biomedical field: often used in biological separation, drug delivery, cell labeling and imaging. By connecting specific antibodies or bioactive molecules to the surface of magnetic beads, efficient capture and separation of specific biomolecules can be achieved.

In the field of environmental science: magnetic beads have a large specific surface area and good adsorption properties. They can efficiently adsorb heavy metal ions, organic pollutants, etc. in water, and achieve rapid separation and recovery through the action of magnetic fields.

Materials science field: by compounding magnetic beads with polymer matrices, composite materials with both magnetic properties and excellent mechanical properties, electrical properties or thermal properties can be prepared.



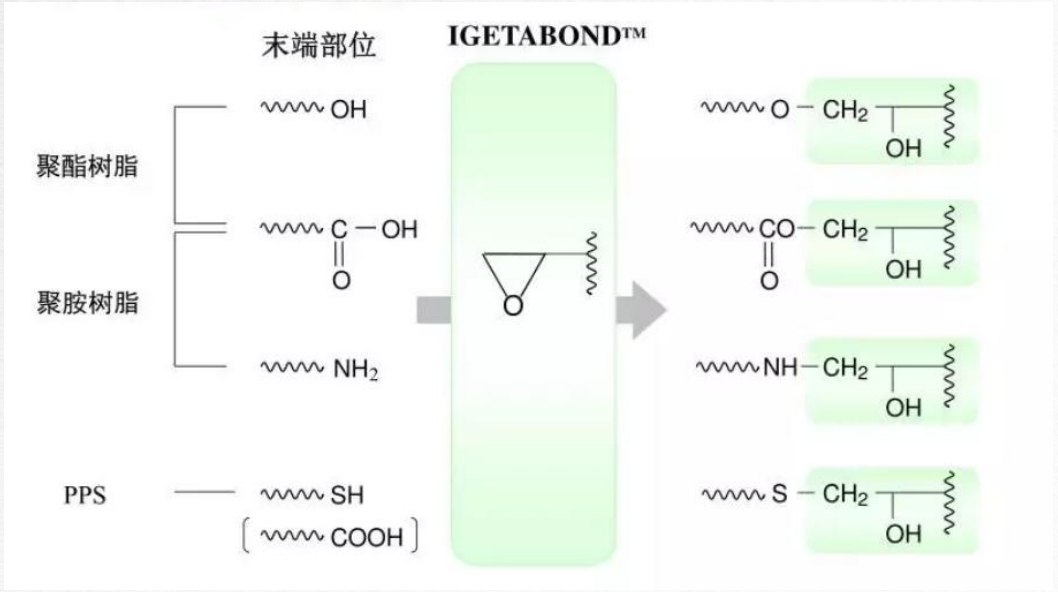


3-3. Polyolefin modified plastics

Ethylene-methyl acrylate-glycidyl methacrylate random terpolymer, polyethylene, polypropylene, polyethylene-octene and other polyolefins are modified by GMA grafting to increase the polarity of the molecular chain, which can significantly improve the bonding ability and hydrophilicity of the polymer and its compatibility with polymers.

As a compatibilizer: high GMA content, good compatibility in PET and PBT; good compatibility with polyolefins, can be used to add compatibilizers in polyester and polyolefin alloys

As a toughening agent: used in PLA to increase the mechanical properties of the material; has excellent toughening effect in PET and PBT, especially better low-temperature toughening effect.

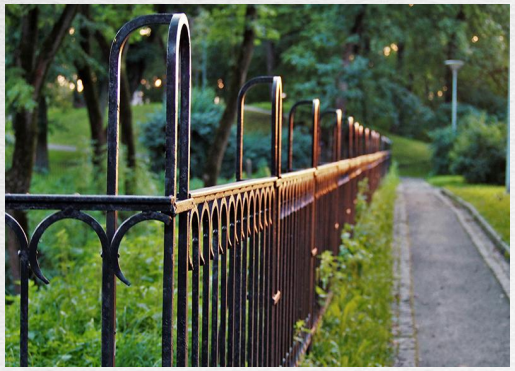


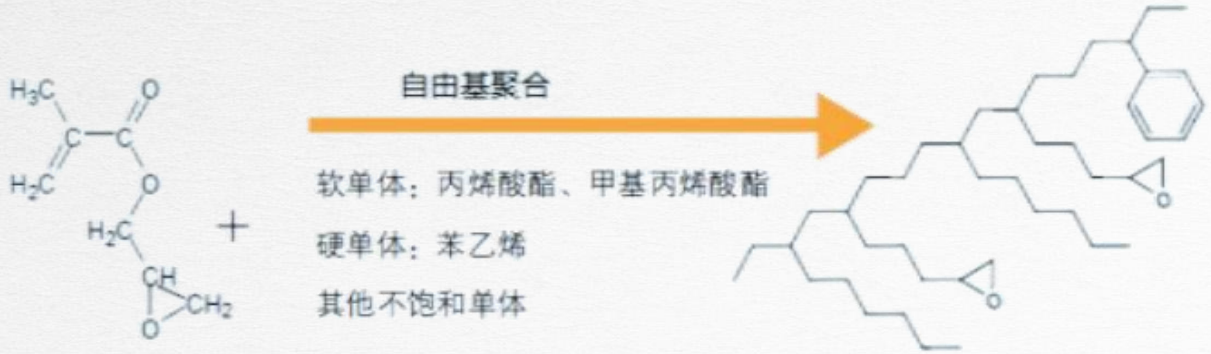
3-4. Powder coating

Epoxy acrylic resin is a glycidyl acrylate copolymer and an epoxy curing agent.

It can be used with carboxyl polyester as a curing agent to significantly increase the crosslinking density of the coating, thereby increasing the hardness of the coating, and improving the chemical resistance and weather resistance of the coating.

It can be compounded into a matting agent, which has a good matting effect on indoor hybrid powder coatings.

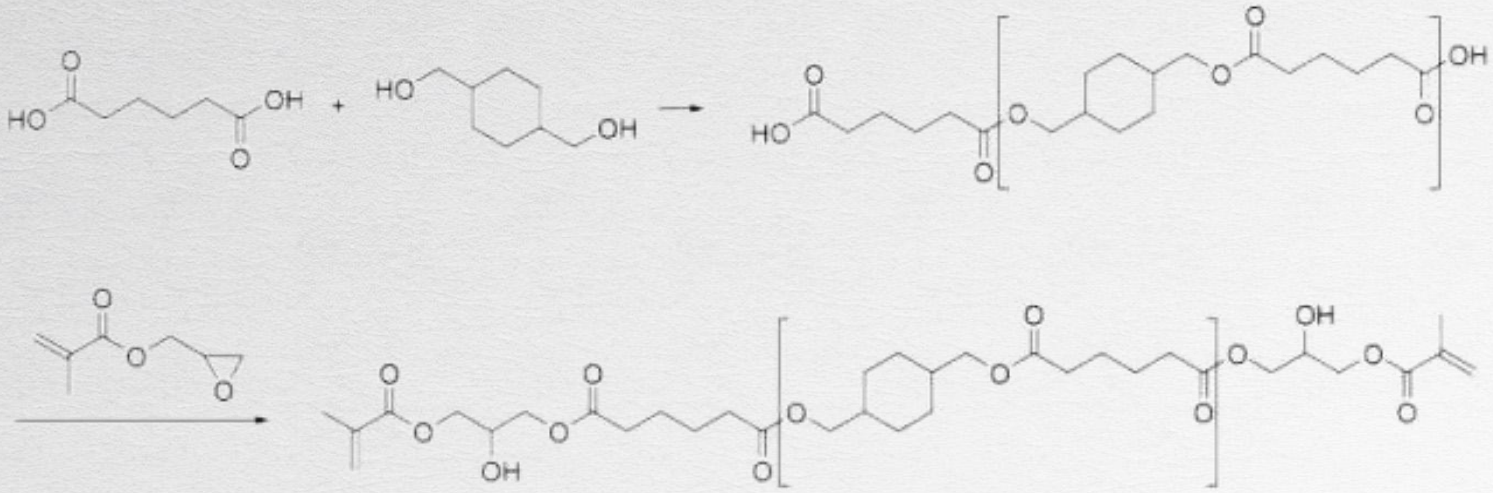




WEI CHENG
玮成新材料 Advanced Material

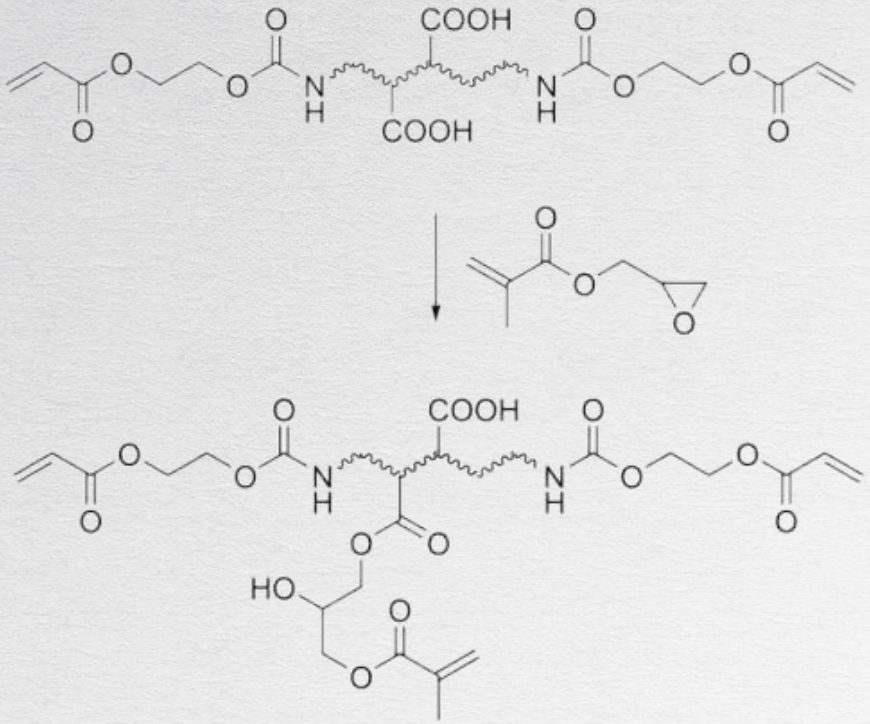
3-5.1. UV resin

GMA contains epoxy groups and can be used to synthesize polyester acrylate. The polyester acrylate synthesized by this method contains hydroxyl groups, which can significantly improve the adhesion of the resin to the substrate after curing.



3-5.2. UV resin

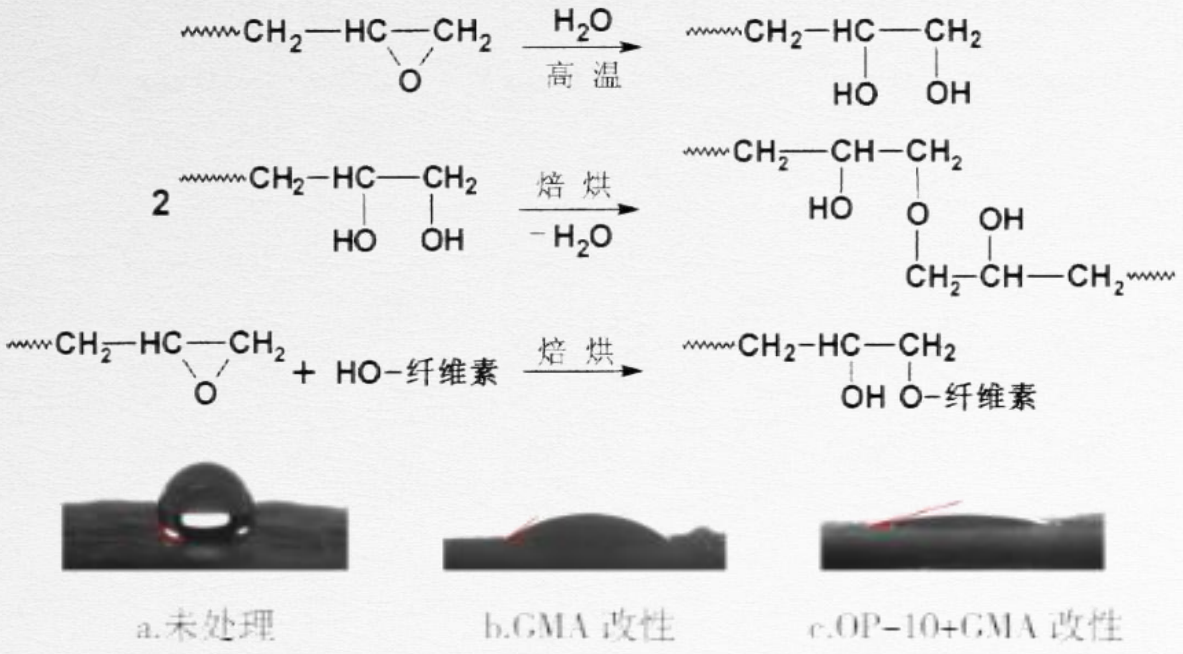
GMA contains epoxy groups and can be used to synthesize multifunctional polyurethane acrylate. After the polyurethane acrylate chain is extended and capped, GMA is added to increase the functionality of PUA and the crosslinking density.



3-6. GMA modified acrylic emulsion (coating printing adhesive)

Mainly improves the thermal stability, water resistance and corrosion resistance of acrylic emulsion on fabrics. This is mainly because the introduction of epoxy groups increases the crosslinking density and polarity.

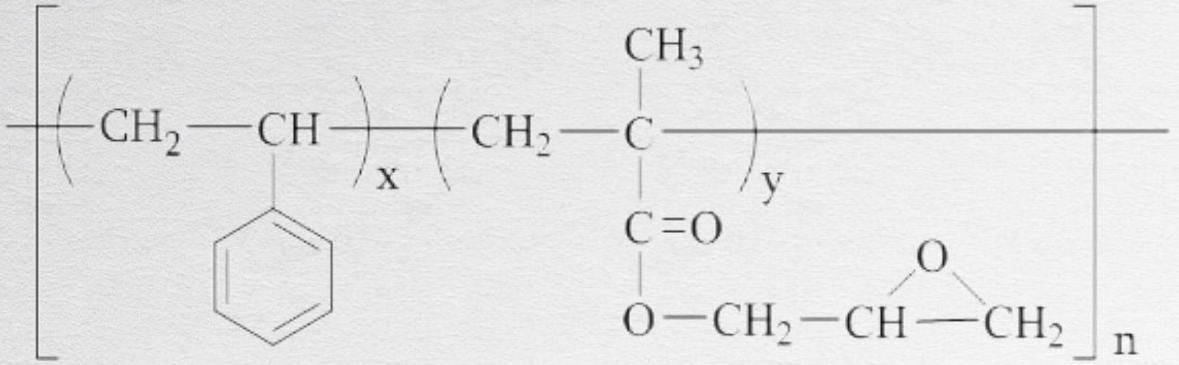
First, the epoxy groups on the polymer are hydrolyzed, then dehydrated and crosslinked into ethers, and the remaining epoxy groups react with the hydroxyl groups on the fabric.



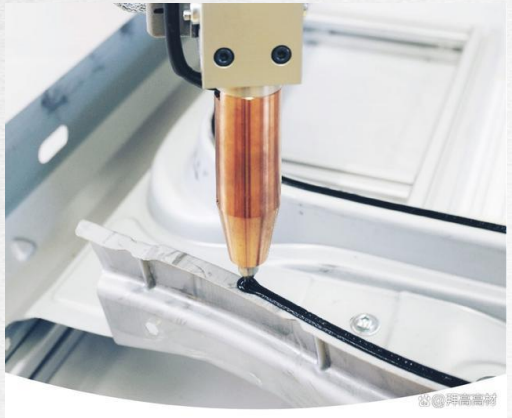
GMA 改性乳液处理前后 PET 织物的表面接触角

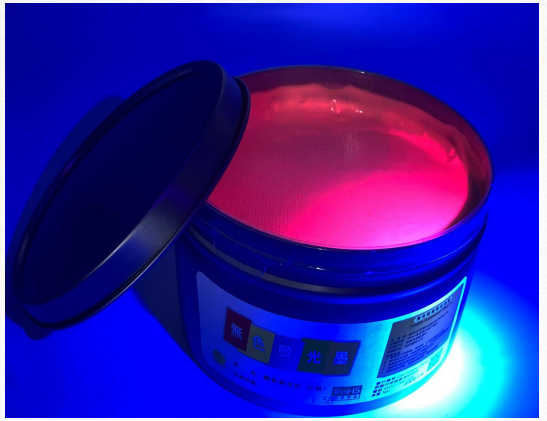
3-7. Other acrylic resins

GMA can be copolymerized with other acrylic esters and vinyl monomers to form resins with different molecular structures, which can be used in thermosetting coatings, adhesives, inks, etc.



GMA 丙烯酸树脂结构





Weicheng New Materials (Shandong) Co., Ltd.

Address: Xuecheng Chemical Industry Park,
Zaozhuang City, Shandong Province

Tel: 0632-7505666

Fax: 0632-7595888

Mobile: 13176033723

Email: tedtan@wchchem.com

Website： www.wchchem.cn www.wchchem.com