

## Information Sheet

Cardura™ E10P Glycidyl Ester

# Reducing the Viscosity of Acrylic Polyols



### Resin Viscosity and VOC

### Meeting global needs

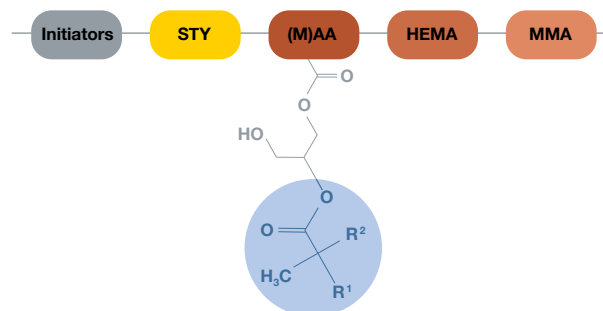
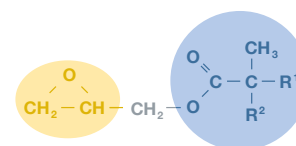
Environmental legislation, customer specifications, and requests for performance or productivity drive the global desire to reduce VOC emissions in solventborne coatings. High solids binder systems are important to achieve these objectives, yet often come with the penalty of higher viscosity. Using Cardura E10P glycidyl ester makes it possible to produce low-viscosity, high-solids acrylic polyols. In addition to lowering resin viscosity, Cardura E10P glycidyl ester also enhances the performance of such resins.

### Cardura Glycidyl Ester

### Cardura glycidyl ester quick facts

Cardura E10P glycidyl ester is a versatile epoxy-ester building block, with a unique hydrophobic bulky structure and is used in the production of a broad range of high-quality polymers such as acrylic and polyester polyols. The key characteristics of Cardura E10P glycidyl ester are:

- Easily reacted with acids for incorporation in acrylic and polyester polyol resins
- High boiling point
- Hydrophobic
- Low surface tension
- UV Resistant
- Resistant to acidic conditions



### Controlling Resin Viscosity

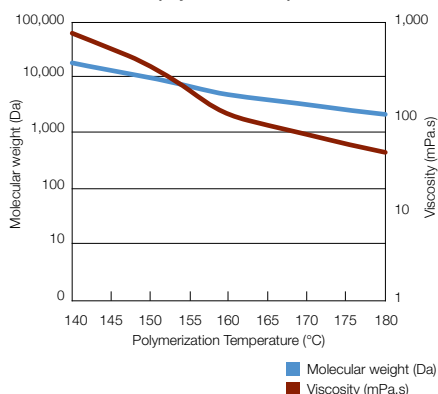
### Molecular weight and viscosity

In order to produce high-solids acrylic polyol (APO) resins with reasonable viscosity, the molecular weight of the resin needs to be reduced. A very practical and economic way to accomplish this is to polymerize at high temperatures. Cardura E10P glycidyl ester is widely used as a reactive solvent for the polymerization of acrylic or methacrylic monomers, thus either replacing partially or entirely the conventional solvent. Because of its very high boiling point (>250 °C), the use of Cardura E10P glycidyl ester allows high polymerization temperatures under normal atmospheric pressure.

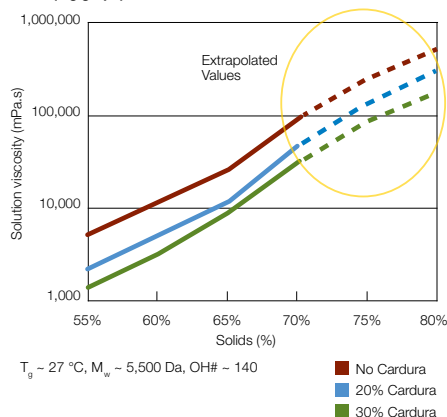
Figure 1 (overleaf) shows the effect of polymerization temperature on both viscosity and molecular weight of an APO. The use of Cardura glycidyl ester (CE10P) in the initial reactor charge made it possible to carry out all the reactions under atmospheric pressure.

After being incorporated into the polymer chain, the bulky ester group of Cardura E10P glycidyl ester functions as a spacer between adjacent polymer chains and weakens hydrogen bonds and other intermolecular forces. Thus, the resulting APO resin exhibits lower viscosity.

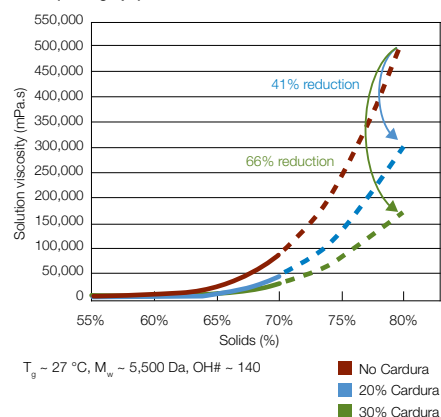
**Fig. 1: Molecular weight and viscosity of APO containing CE10P as a function of polymerization temperature**



**Fig. 2: Viscosity vs. Solids for APOs with and without CE10P (log graph)**



**Fig. 3: Viscosity vs. Solids for APOs with and without CE10P (linear graph)**



The more Cardura E10P glycidyl ester used in the resin backbone, the lower the final resin viscosity. The use of Cardura E10P glycidyl ester allows for significant viscosity reduction of APO resins with similar  $T_g$  and  $M_w$ .

## Summary

### High-solids high-performance low-viscosity APO resins are easily produced with Cardura E10P glycidyl ester

- The high boiling point of Cardura E10P glycidyl ester allows for its use as a reactive solvent in high-temperature synthesis of APO resins under atmospheric pressure
- Cardura E10P glycidyl ester is easily incorporated into the backbone of APO resins via reaction with acid functional monomers
- The bulky aliphatic ester group of Cardura E10P glycidyl ester minimizes the interactions between polymer chains, reducing their viscosity at the same solids level
- The viscosity-reduction effect increases with the concentration of Cardura E10P glycidyl ester
- In addition to reducing viscosity, Cardura E10P glycidyl ester enhances APO performance, yielding coatings with extended UV durability, acid resistance, and excellent appearance

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