

## SMA<sup>®</sup> EF60 and EF80 Resins Provide Enhanced Electrical Properties for Printed Circuit Boards



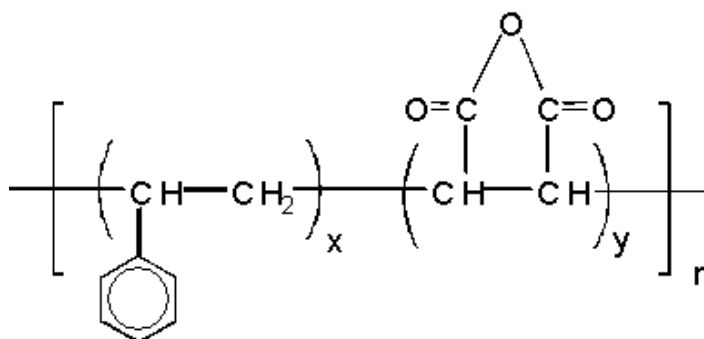
### Benefits

- Lower dissipation factors (Df) and dielectric constants (Dk)
- Lower melt viscosity
- Compatibility with a wide variety of conventional epoxy curing catalysts
- High solubility in typical solvents - eliminating need for aggressive solvents (e.g., dimethyl formamide)

### Description

SMA<sup>®</sup> EF60 and EF80 resins represent the next generation of low molecular weight styrene-maleic anhydride copolymers from the family of resins, which includes SMA EF30 and EF40. SMA EF60 and EF80 have 6:1 and 8:1 styrene:maleic anhydride ratios, respectively. These products demonstrate sufficient reactivity to effectively crosslink epoxy resins. SMA EF60 and EF80 are expected to exhibit excellent stability and low water uptake, and to contribute to lower dissipation factors (Df) and dielectric constants (Dk) in printed circuit board laminates. The general structure for the SMA EF resins is shown below.

### Structures of SMA<sup>®</sup> EF60 and EF80 Resins



#### SMA EF60

$$\begin{aligned} X &= 6 \\ Y &= 1 \end{aligned}$$

#### SMA EF80

$$\begin{aligned} X &= 8 \\ Y &= 1 \end{aligned}$$

# TECHNICAL UPDATE

New SMA® EF60 and EF80 Resins: Provide Enhanced Electrical Properties for Printed Circuit Boards



The table below lists typical properties for SMA EF60 and EF80.

## Typical Properties of SMA® EF60 and EF80 Resins

Property	SMA EF60	SMA EF80
Styrene : Maleic Anhydride	6:1	8:1
M <sub>w</sub>	11,500	14,400
M <sub>n</sub>	5,500	7,500
Metal Content (Na, Fe, or Mg)	<10 ppm	<10 ppm
Chloride Ion Content	<20 ppm	<20 ppm
Acid Number (mg KOH/g resin)	141-171	105-135
Residual Styrene	<0.20%	<0.20%
Residual Maleic Anhydride	<0.01%	<0.01%
Melt Viscosity (poise) <sup>(1)</sup>		
@ 180 °C	479	573
@ 200 °C	71	105
Tg (°C)	106	104
(1) Measured using Brookfield RVT Viscometer; 0.5 rpm; spindle no. 21.		

# TECHNICAL UPDATE

New SMA® EF60 and EF80 Resins: Provide Enhanced Electrical Properties for Printed Circuit Boards



**CRAY VALLEY**

Hydrocarbon Specialty Chemicals

The list below illustrates the key benefits that SMA EF60 and EF80 bring to printed circuit board production.

## Key Features of SMA® EF60 and EF80 Resins

- ✓ Certified for very low levels of metal and chloride ion
- ✓ Narrow QC specifications (acid number and intrinsic viscosity) for lot-to-lot uniformity
- ✓ Very low water content / low water absorption properties give excellent shelf stability and uniform curing behavior
- ✓ Compatibility with a wide variety of conventional epoxy curing catalysts
- ✓ High solubility in various solvents allows use of conventional laminate processing systems and can eliminate the need for high boiling and aggressive solvents, such as dimethyl formamide.

\*The listed properties are illustrative only, and not product specifications. Cray Valley disclaims any liability in connection with the use of the information, and does not warrant against infringement by reason of the use of its products in connection with other materials or in any process.