

Water Absorption By SMA[®] Resins

Hydrolytically Stable Polyanhydride Curing Agents for Epoxy Resins

SMA[®] Resins are less susceptible to water absorption and hydrolysis and should thus exhibit more consistent curing with epoxy resins than conventional small molecule anhydrides. Moisture pick-up and subsequent hydrolysis to the diacid is a problem associated with the use of low molecular weight anhydrides, especially when they are improperly stored under hot and humid conditions. In contrast, SMA[®] Resins resist water absorption due to their high hydrophobicity. In general the higher the resin styrene content, the lower the amount of water that will be absorbed at a given relative humidity (RH).

Equilibrium moisture absorbing capacities of various SMA[®] Resins were determined by gravimetric sorption analysis, while samples of nadic methyl anhydride were stored above constant humidity solutions and checked periodically for weight gain. These results are summarized in the table below. While SMA[®] 1000 is the most absorbent of the SMA[®] base resins, it is still much less prone to hydrolysis than nadic methyl anhydride, illustrating that competing small molecule anhydrides are much more sensitive to storage conditions than SMA[®] Resins. It is particularly noteworthy that the grades of SMA[®] recommended as epoxy curing agents (EF30, EF40) exhibit very low water absorption.

Material	30% RH (at 25°C)		60% RH (at 25°C)		90% RH (at 25°C)	
	wt. Change (%)	Hydrolysis ¹ (%)	wt. Change (%)	Hydrolysis (%)	wt. Change (%)	Hydrolysis (%)
SMA [®] 1000	0.23	7.62	0.78	14.83	1.39	22.75
SMA [®] EF30	0.11	2.38	0.23	4.86	0.34	7.25
SMA [®] EF40	0.12	3.20	0.21	5.60	0.31	8.20
Nadic methyl anhydride ²	0.58	5.75	2.95	29.08	5.34	52.95

1 Hydrolysis (%) = mole percent of anhydride groups hydrolyzed to diacid groups.

2 Min. wt. change, as there is some sublimation of Nadic methyl anhydride at low R.H.

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