

## Supporting information

### Selective cleavage of ester linkages of anhydride-cured epoxy using a benign method and reuse of the decomposed polymer in new epoxy preparation

Tuan Liu,<sup>a</sup> Xiaolong Guo,<sup>a</sup> Wangcheng Liu,<sup>a</sup> Cheng Hao,<sup>a</sup> Liwei Wang,<sup>a</sup> William C. Hiscox,<sup>b</sup>  
Chengyun Liu,<sup>a</sup> Can Jin,<sup>a,c</sup> Junna Xin,<sup>a</sup> and Jinwen Zhang<sup>a\*</sup>

**Table S1.** The solubility of the decomposed polymer (DMP)

Solvent	Water	Ethanol	Acetone	Methanol	Tetrahydrofuran
Solubility	-	±	+	±	+
Solvent	Hexane	Chloroform	Dichloromethane	Ethyl ether	Ethyl acetate
Solubility	-	-	-	-	+

-: insoluble; +: soluble; ±: partially soluble

The DMP was obtained from the reaction conditions of 190 °C, 0.2 g HPW in 19.8 g water, 6 g cured epoxy, 5 h.

**Table S2.** Water absorption of anhydride-cured epoxy in different temperatures

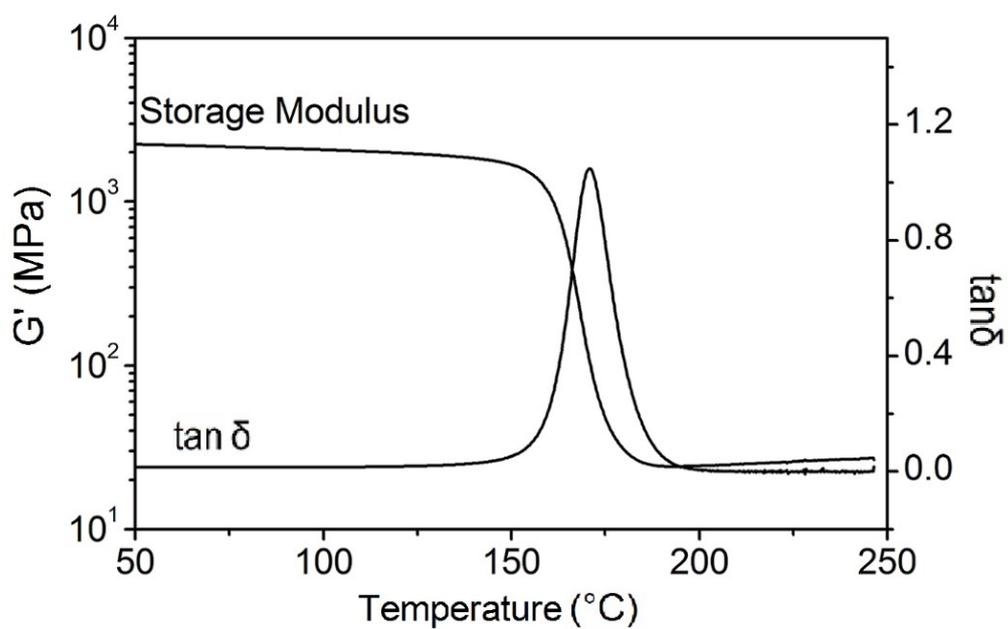
	130 °C	150 °C	170 °C	190 °C
Weight increase (wt%)	1.7	1.8	5.3	5.6 <sup>a</sup>

<sup>a</sup> Because the sample was slightly decomposed at 190 °C, the data may not accurate.

Water cannot effectively permeate into the cross-linked network below the  $T_g$  of sample. That is because epoxies usually possess high crosslink density and stable chemical structures which render excellent barrier properties to water. Only when the reaction temperature reaches to the  $T_g$ , the chain segments will have adequate mobility to allow the water/catalyst system to effectively permeate into the sample and cleave some of the chemical bonds of the polymer.

**Table S3.** Formulations of the new epoxy curing systems.

Samples	DER 331 epoxy		NMA curing agent		DMP		
	Mass (g)	Epoxy (mol)	Mass (g)	Anhydride (mol)	Mass (g)	Hydroxyl (mol)	Carboxyl (mol)
Neat	100	0.53	75.8	0.43	0	0	0
5 wt% DMP	95	0.5	75.8	0.43	5	0.11	0.02
10 wt% DMP	90	0.48	75.8	0.43	10	0.23	0.03
20 wt% DMP	80	0.42	75.8	0.43	20	0.45	0.07
30 wt% DMP	70	0.37	75.8	0.43	30	0.68	0.10
40 wt% DMP	60	0.32	75.8	0.43	40	0.90	0.13
50 wt% DMP	50	0.27	75.8	0.43	50	1.13	0.17



**Fig. S1** DMA curves of anhydride-cured epoxy before degradation.

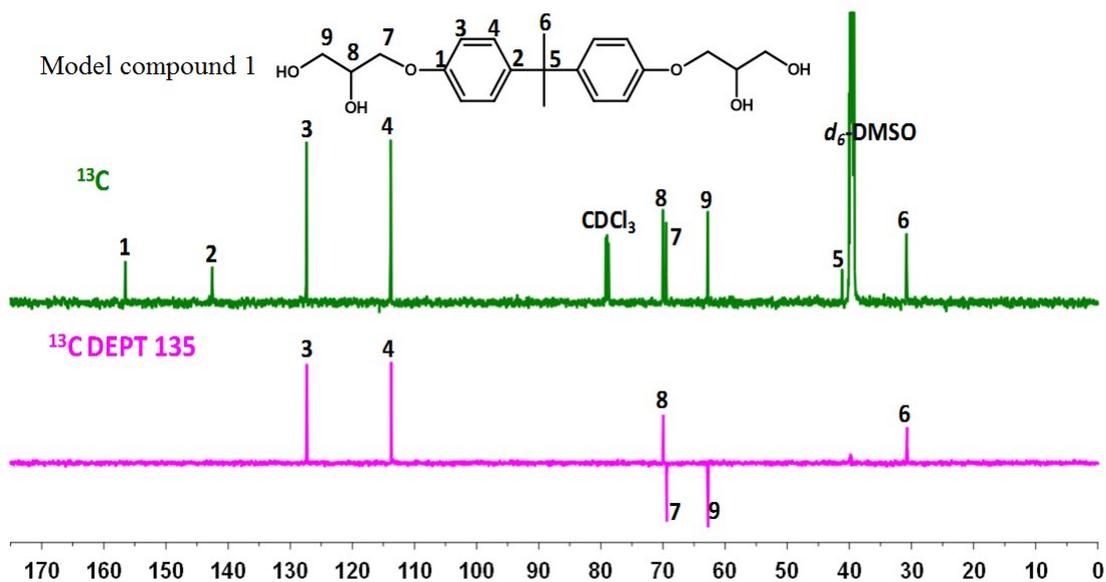


Fig. S2  $^{13}\text{C}$ -NMR spectra of model compound 1.

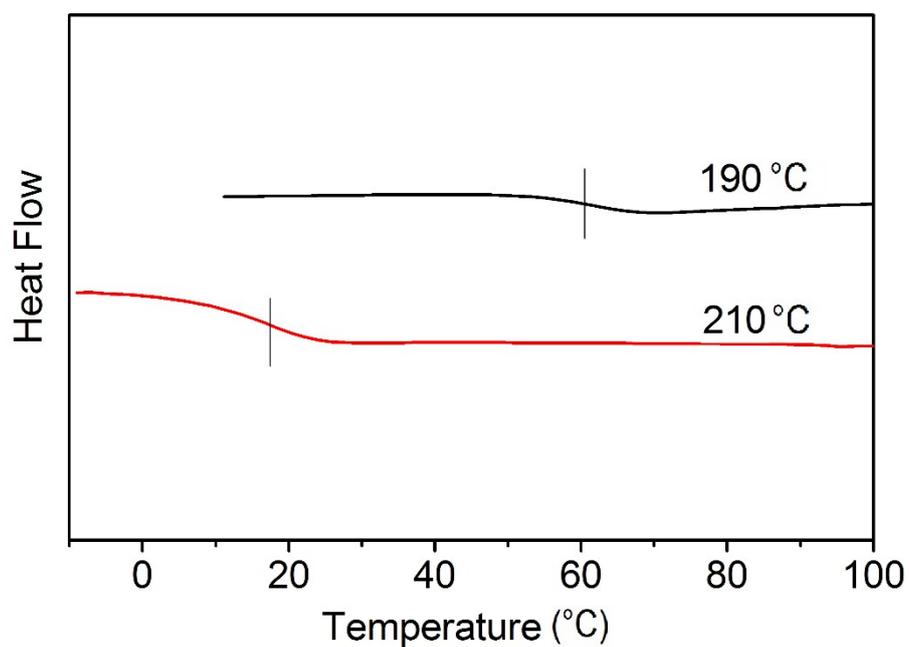


Fig. S3 DSC curves of DMP from different reaction temperature.

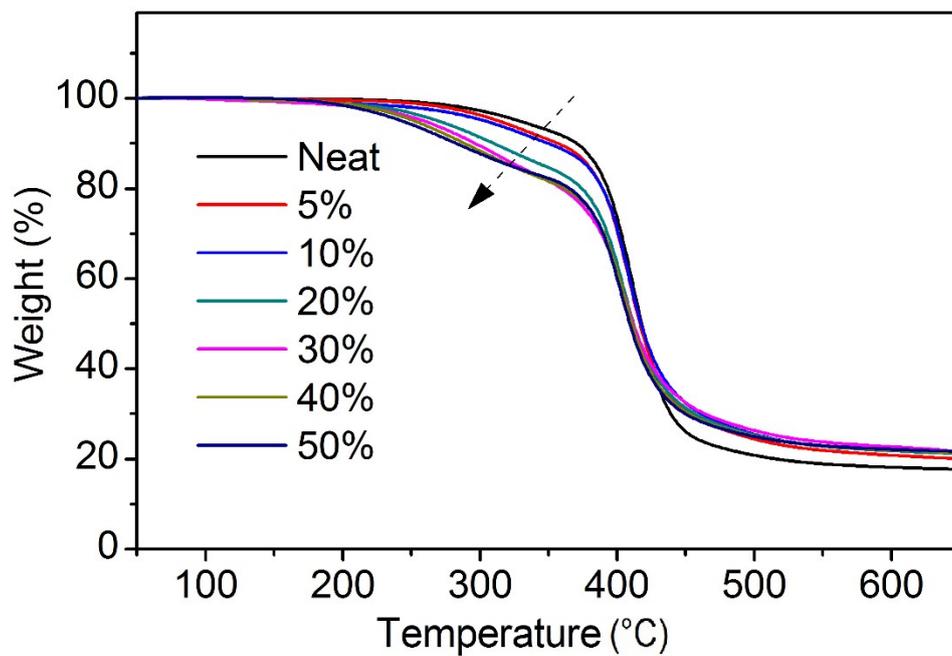


Fig. S4 TGA curves of the new epoxy materials with different DMP loading contents.

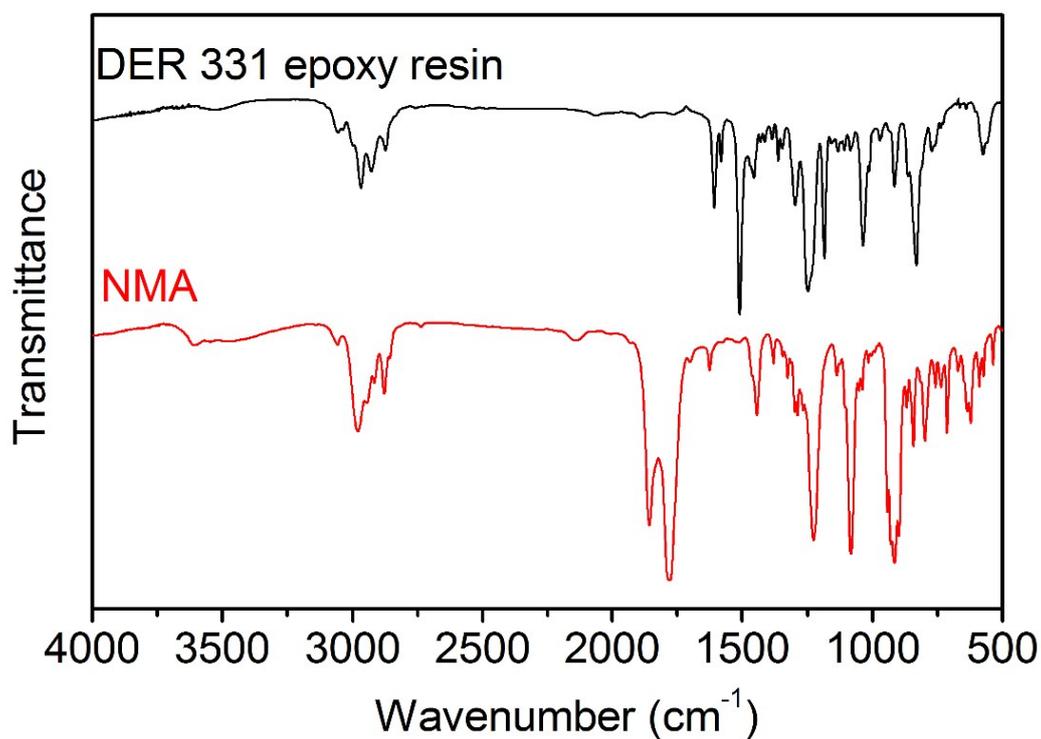
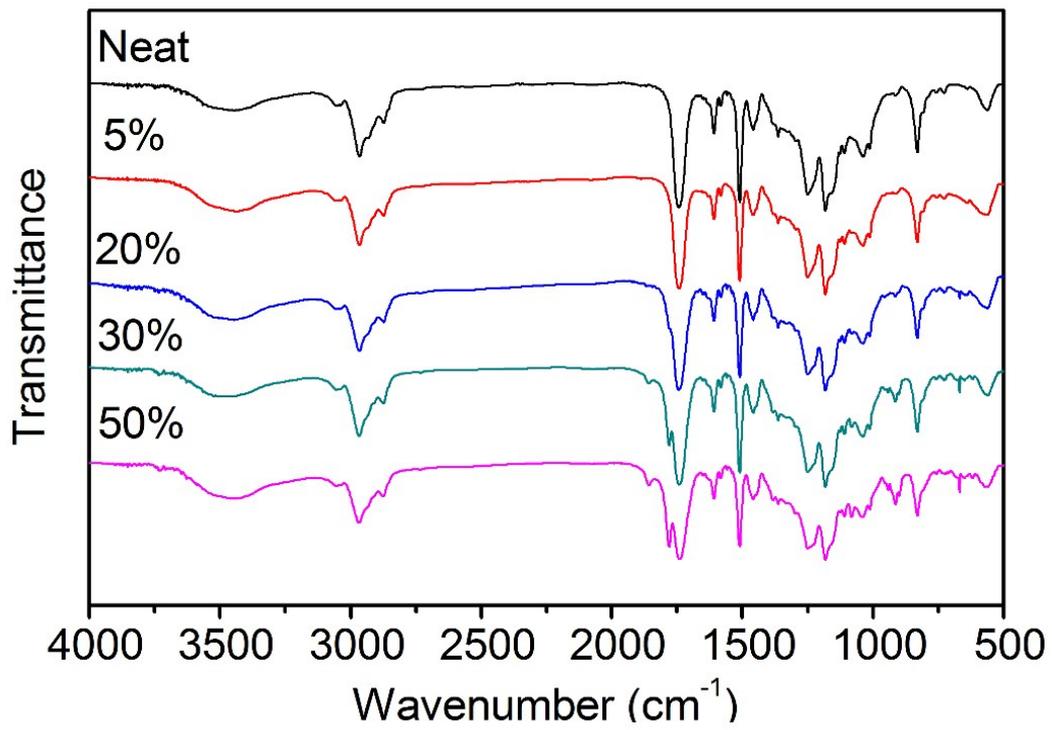


Fig. S5 FTIR spectra of DER 331 and NMA.



**Fig. S6** FTIR spectra of anhydride-cured epoxy with different DMP contents.