Supporting Information for

Study on a reliable epoxy-based phase change material: facile preparation, tunable properties, and phase/microphase separation behavior

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1. The state of D18 at different temperatures

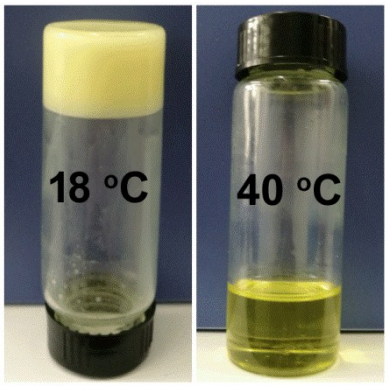

Figure S1. The state of D18 at 18 °C (room temperature) and 40 °C.

In **Figure S1**, the synthetic D18 is a solid state at room temperature. The light yellow transparent liquid of D18 can be seen when the temperature is above 40 °C.

2. Phase transition process of ODT and D18

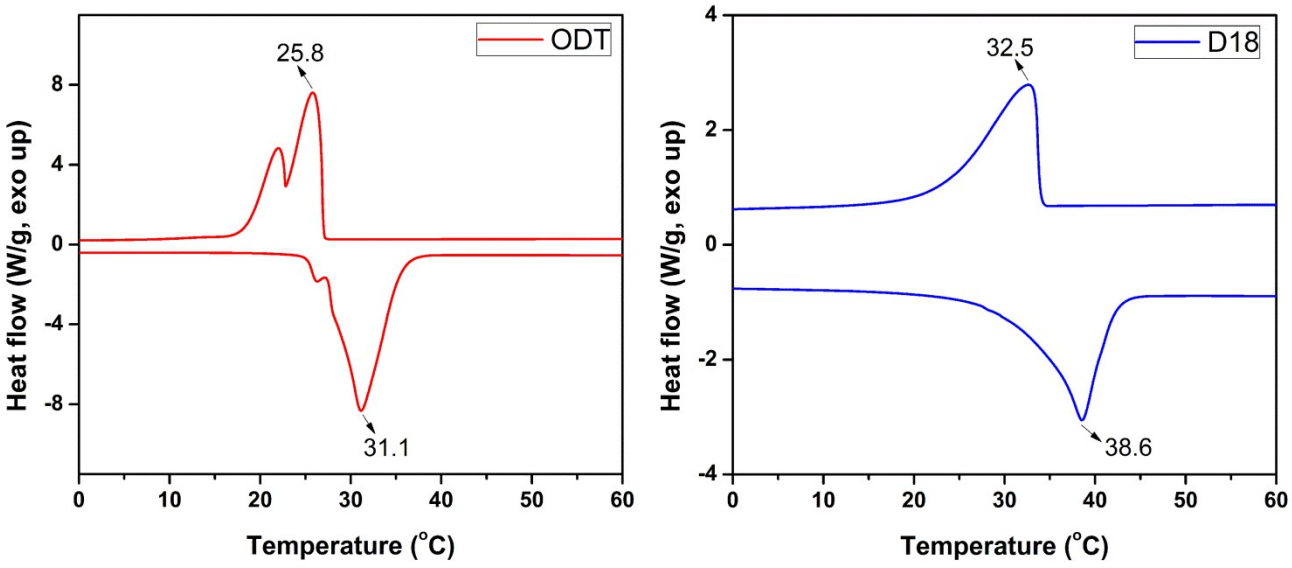

Figure S2. DSC curves of ODT and D18.

Figure S2 is the DSC curves of ODT and D18. Owing to the similar structure of ODT and paraffin, the

first small melting peak below 31.1 °C (at around 26 °C) could be attributed to the solid–solid phase change of ODT and the second sharp melting peak at 31.1 °C corresponds to the solid–liquid phase change of ODT.[1] We can observe that both the melting point and freezing point of D18 are higher than that of ODT. Actually, the melting point of crystalline polymers is related to the flexibility of the chain segments, and higher flexibility can cause lower melting point. When ODT was grafted on the rigid epoxy backbone, the flexibility of the alkyl chain segments of ODT decreased, which can directly cause the increasing of the melting point and the crystalline point.

3. X-ray diffraction diagrams of ODT and D18

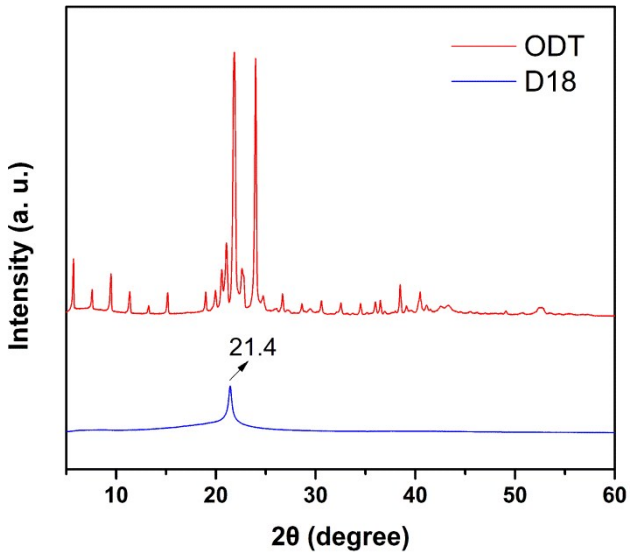

Figure S3. X-ray diffraction diagrams of ODT and D18.

Figure S3 is the XRD diagrams of ODT and D18. There is only one sharp crystalline peak at 21.4 degree for D18, which proves that the crystalline property of ODT is restricted by the DADGEBA backbone.

4. Thermal recycling properties of $EP_{D18\text{-}X}$ systems

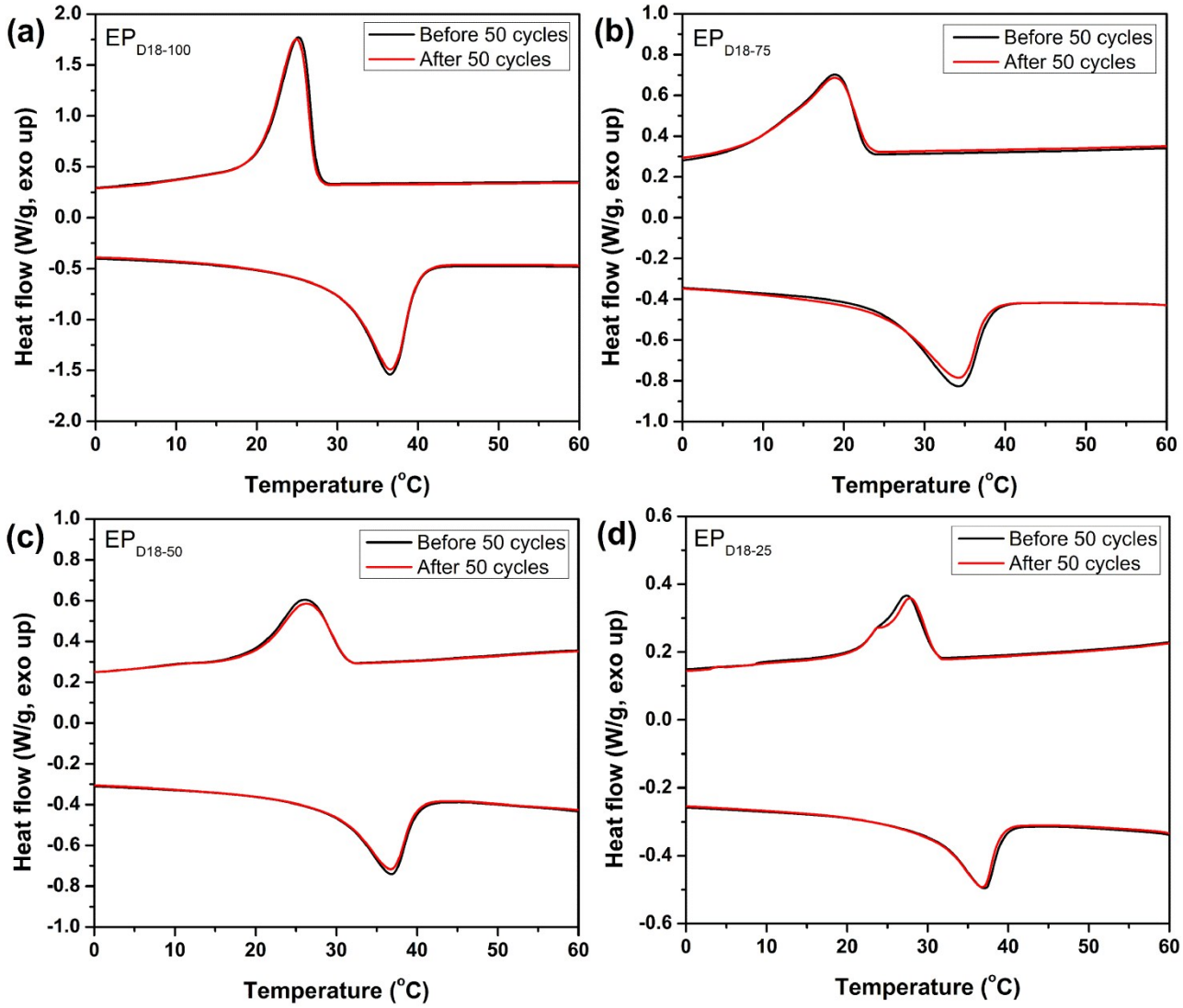

Figure S4. DSC curves of $EP_{D18\text{-}X}$ PCMs before and after 50 thermal cycles.

Table S1. The variation of Tg, T_m, and T_f before and after 50 thermal cycles.

System	Tg^1 (°C)	Tg^{50} (°C)	Melting Process		Freezing Process	
			T_m^1 (°C)	T_m^{50} (°C)	T_f^1(°C)	T_f^{50}(°C)
$EP_{D18\text{-}100}$	/	/	36.5	36.7	25.1	24.8
$EP_{D18\text{-}75}$	58.3	58.9	34.0	34.1	18.7	18.9
$EP_{D18\text{-}50}$	61.2	61.4	36.6	36.5	25.8	26.0
$EP_{D18\text{-}25}$	70.9	71.2	36.9	36.6	27.3	27.7

In **Figure S4**, it is obvious that the thermal and cooling latent heat loss after 50 DSC thermal cycles is very limited. Besides, no significant change was observed in Tg, T_m, and T_f of the $EP_{D18\text{-}X}$ PCMs before and

after 50 thermal cycles in **Table S1**. The results suggest that the epoxy-based polymeric SSPCMs is very stable during the thermal cycling test.

5. TGA curves of ODT, D18, and DADGEBA

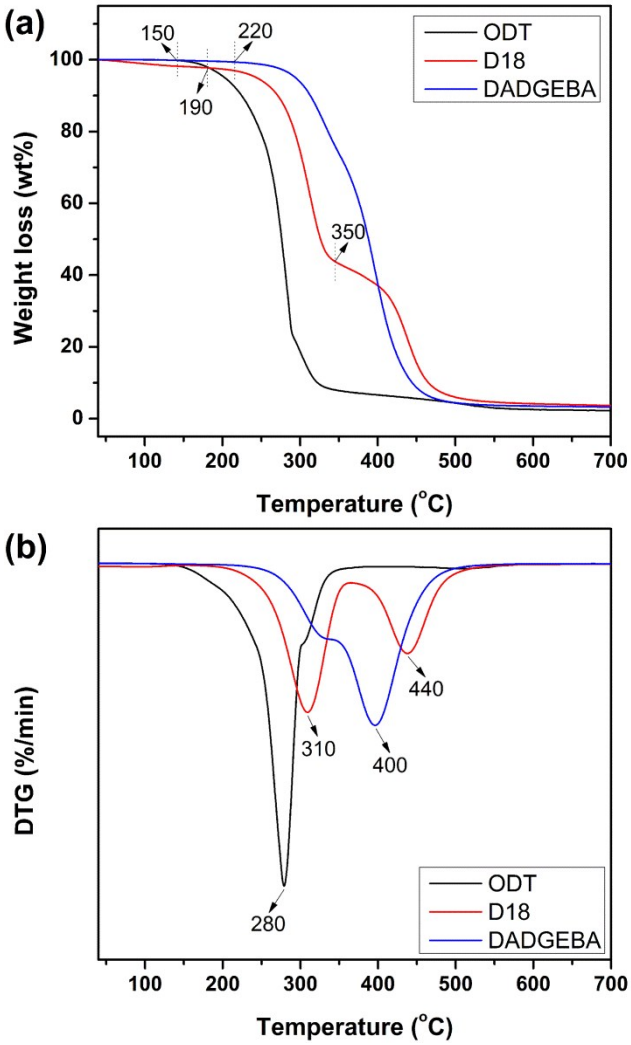

Figure S5. Thermal stability analysis of ODT, D18, and DADGEBA: (a) TG curves; (b) DTG curves.

In **Figure S5**, it's obvious that the thermal stability of ODT is less than that of DADGEBA, and the starting thermal decomposition temperature of ODT can be increased from 150 to 220 °C after ODT was grafted on the backbone of DADGEBA to form D18, the result of which shows that the thermal stability of ODT

can be greatly increased via the grafting reaction. Besides, the DTG curve of D18 shows two distinct thermal decomposition peaks at 310 ^{o}C and 440 ^{o}C, which is attributed to the decomposition of the ODT side chains and the DADGEBA main chains, respectively.

References

1. Q. Zhang, Y. Zhao and J. Feng, *Solar Energy Materials and Solar Cells*, 2013, **118**, 54-60.