

# Supporting Information

Facile synthesis and characterization of thermoplastic polyamide elastomers based on semicrystalline PA1212 and amorphous polyetheramine

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## 1. Measurement

**Polarized optical microscopy (POM).** The crystallization morphology of all samples was conducted on polarized optical microscopy (POM) apparatus (Olympus BX51, Japan) with a digital hot plate and a CCD camera. Samples were sandwiched between two glass slides with a gentle press. Samples were melted and pressed at 210 °C for 5 min to eliminate any thermal history, and then rapidly cooled to the designated temperature 145 °C at a rate of 50 °C min<sup>-1</sup> and kept isothermal at the temperature for 15 min. The homo PA1212 was employed for comparison.

**Thermal Gravimetric Analysis (TGA).** Thermal stability of samples was studied on a NETZSCH TG 209 F1 (Germany) by heating a sample with around 5 mg initial weight from 25 °C to 600 °C at a rate of 10 °C min<sup>-1</sup> under nitrogen atmosphere.

## 2. Results and discussion

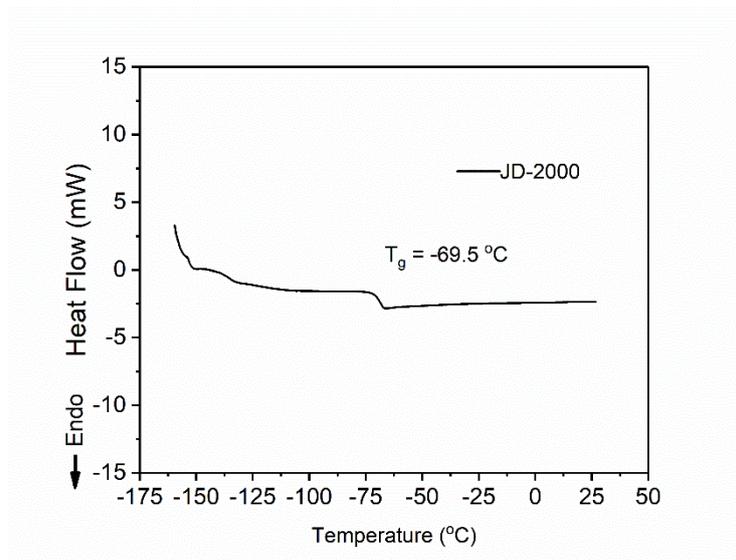


Figure S1. DSC thermogram of Jeffamine D2000.

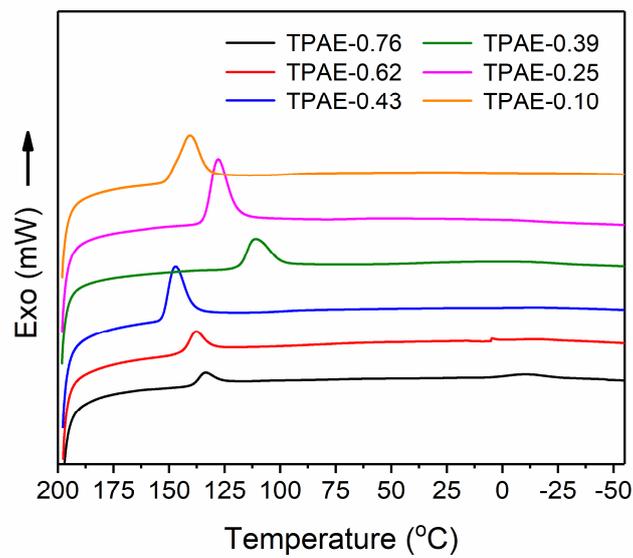
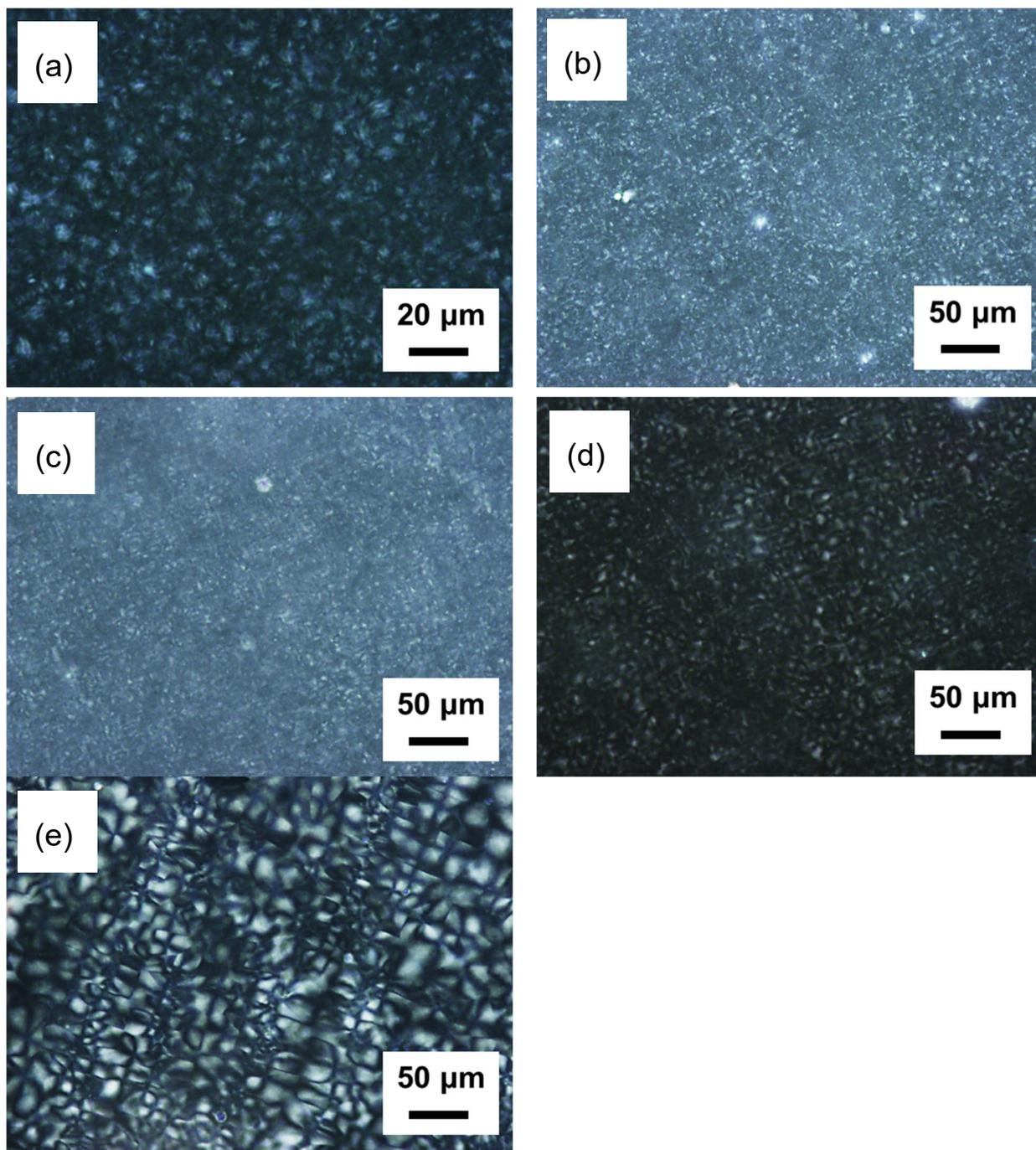
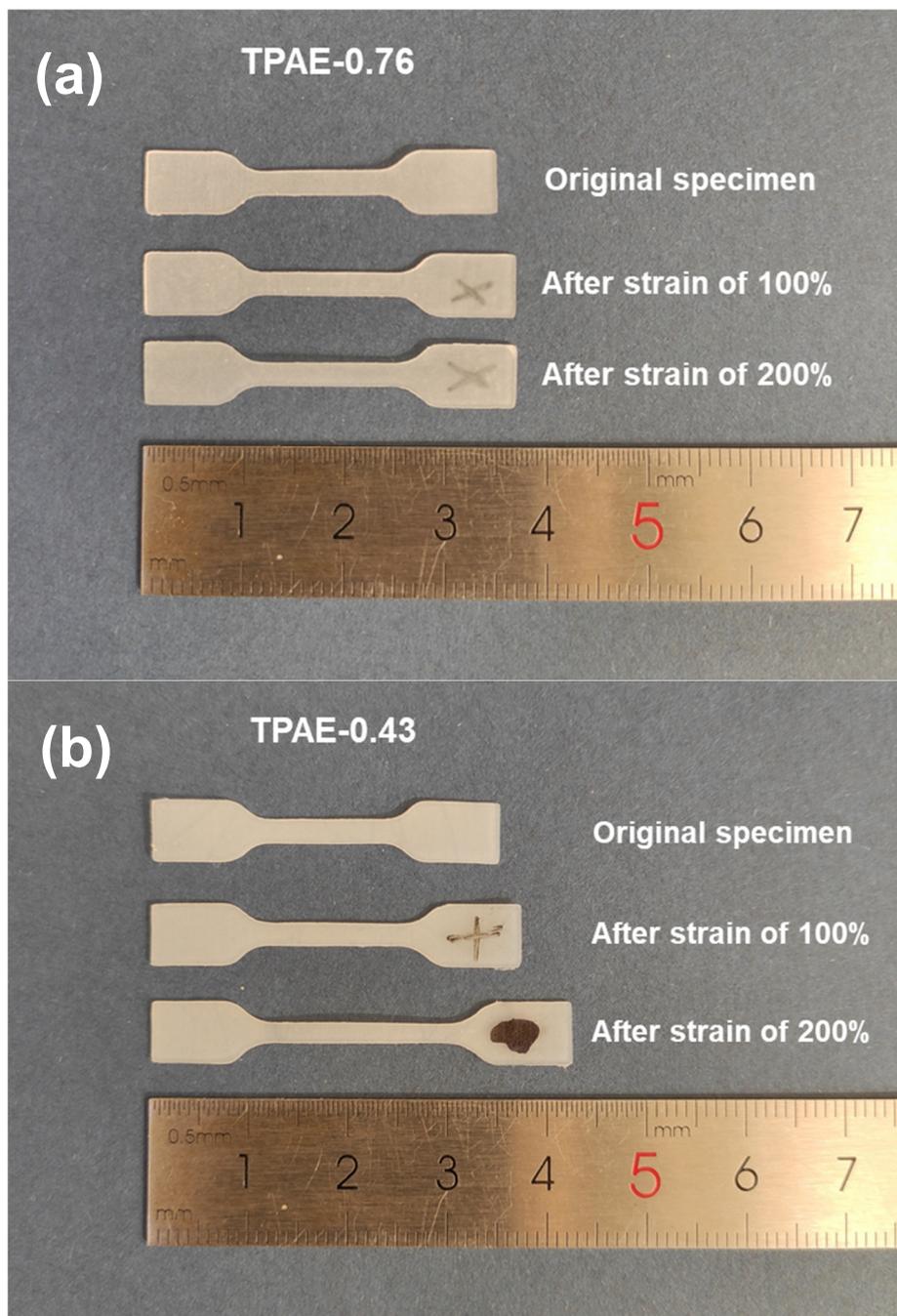


Figure S2. DSC thermogram of TPAEs.



**Figure S3.** POM images of (a,b) TPAE-0.39, (c) TPAE-0.25 (d) TPAE-0.10, (e) homo PA1212



**Figure S4.** Photos of specimens before and after cyclic tensile testing for (a) TP AE-0.76 (b) TP AE-0.43 (stored at room temperature overnight).

**Table S1.** The residual strain of the specimens after cyclic tensile testing.

	Strain	
	100%	200%
TPAE-0.76	16%	41%
TPAE-0.43	30%	94%

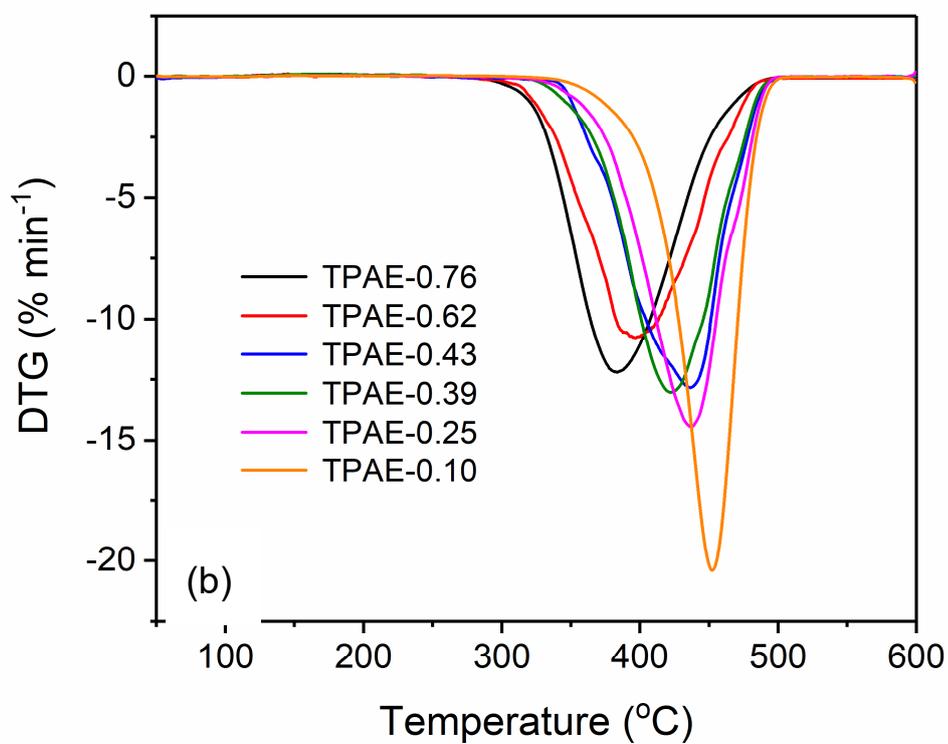
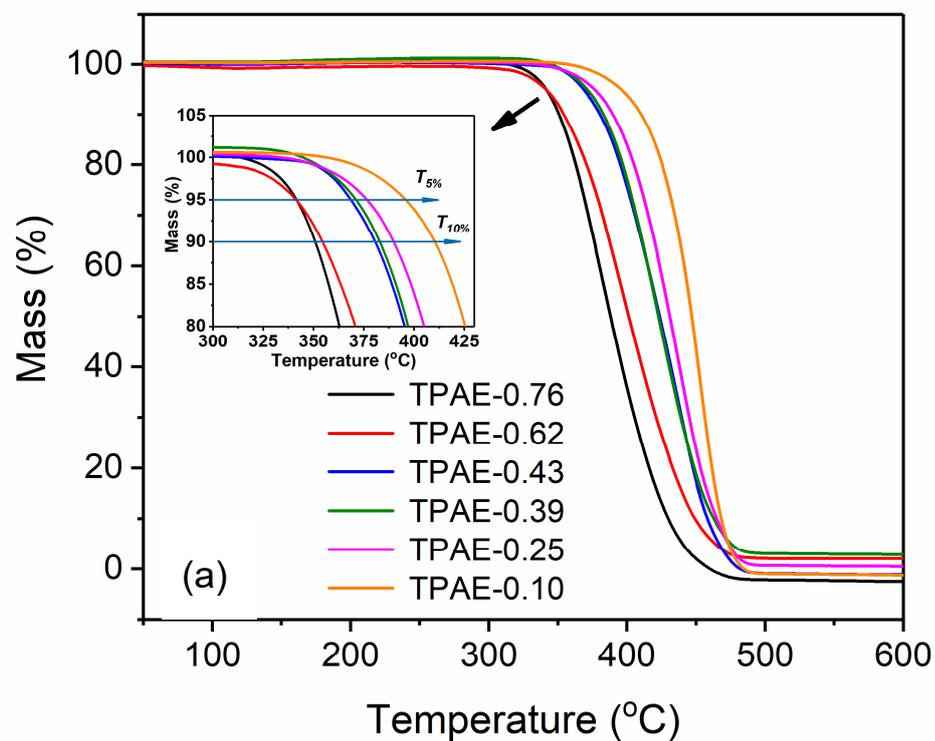


Figure S5. Thermal gravimetric curves of TPAs.

TGA was employed to study the thermal stability of TPAs and the corresponding curves are shown in Figure S5. The

temperatures at 5% of decomposition ( $T_{5\%}$ ), 10% of decomposition ( $T_{10\%}$ ), and maximum decomposition temperature ( $T_{max}$ ) of the TPAs are listed in Table 3. The initial decomposition temperature ( $T_{5\%}$ ) of all samples are above 340 °C that is far over the processing temperature ca. 210 °C. Generally, as the polyamide content increases, the  $T_{5\%}$ ,  $T_{10\%}$  and  $T_{max}$  increase. The thermal stability of the TPAs containing PPG segment (C3) is lower than that using PPDO (C3) as soft segment because the tertiary carbons are prone to break up under high temperature. The six copolymers display one-step decomposition procedure. It appears that the copolymers with high amount of soft segment have relatively low maximum decomposition temperature although the thermal stability of pristine polyetheramine is poorer than that of homo PA1212. These results reveal that diamine terminated PPG based TPAs can keep good thermal stability in processing.

**Table S2.** Characteristic thermal degradation parameters of TPAs.

Sample code	$T_{5\%}$ (°C)	$T_{10\%}$ (°C)	$T_{max}$ (°C)
TPAE-0.76	341.2	350.7	384.2
TPAE-0.62	341.7	354.4	397.4
TPAE-0.43	368.5	380.9	436.3
TPAE-0.39	371.3	382.9	422.6
TPAE-0.25	376.4	389.9	437.1
TPAE-0.10	395.9	410.4	452.4