- Supporting Information -

Thermoplastic polyester elastomers based on long-chain crystallizable aliphatic hard segments

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1. Polymer thermal properties and molecular weights

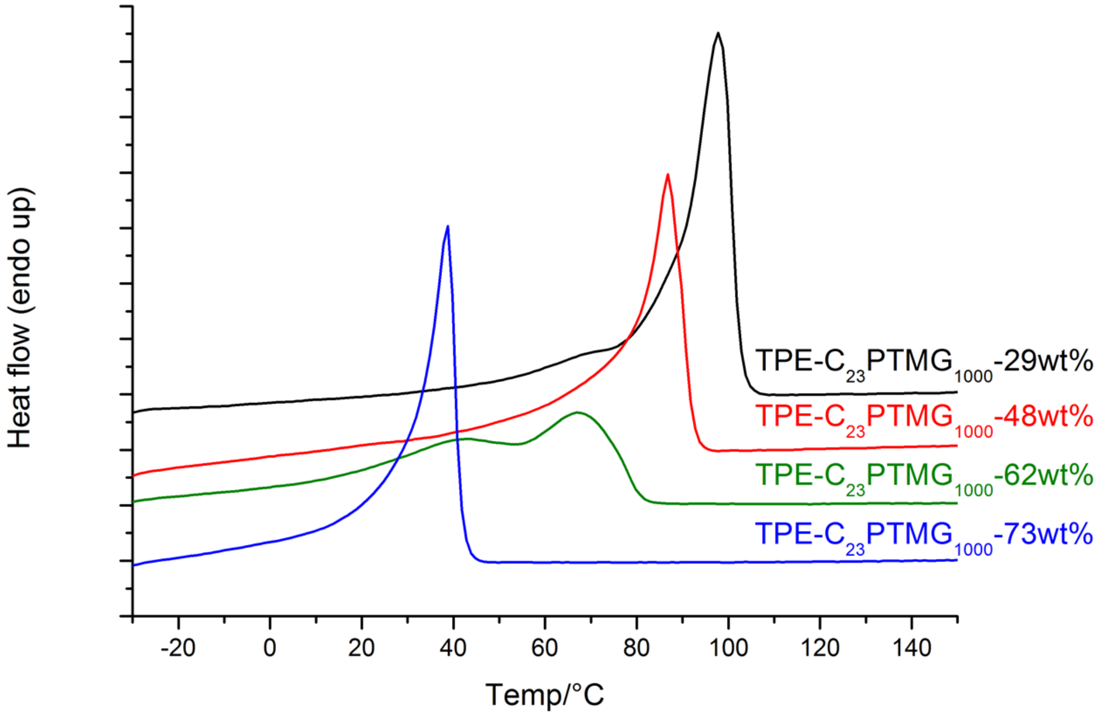

Figure S1. DSC thermograms (second heating) of polyester-polyether copolymers based on $PTMG_{1000}$.

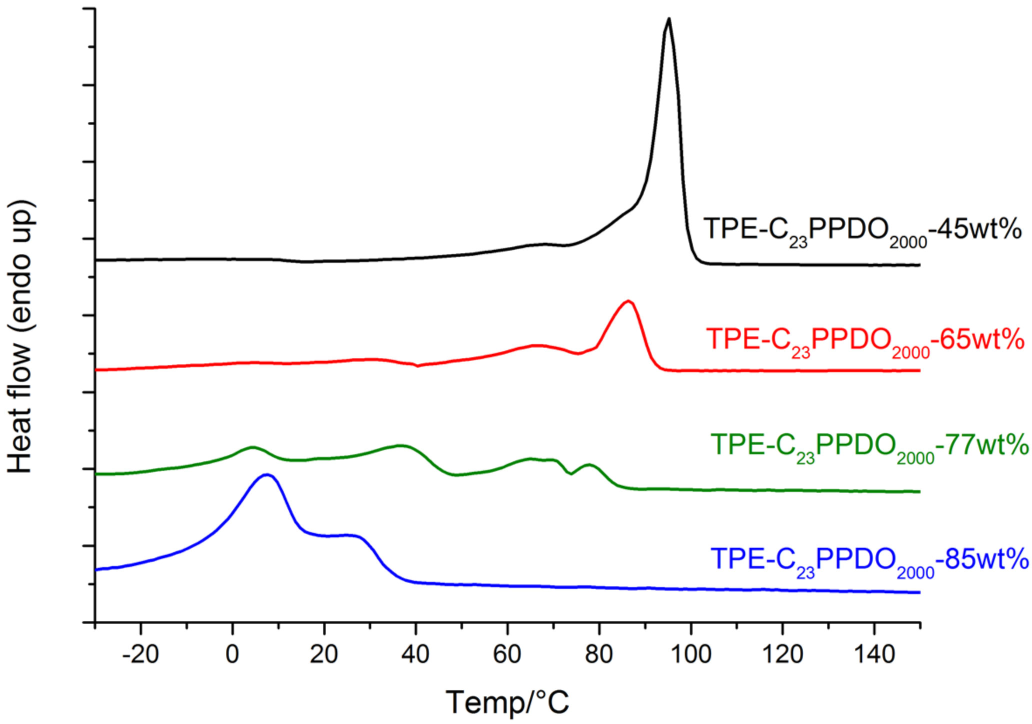

Figure S2. DSC thermograms (second heating) of polyester-polyether copolymers based on $PPDO_{2000}$

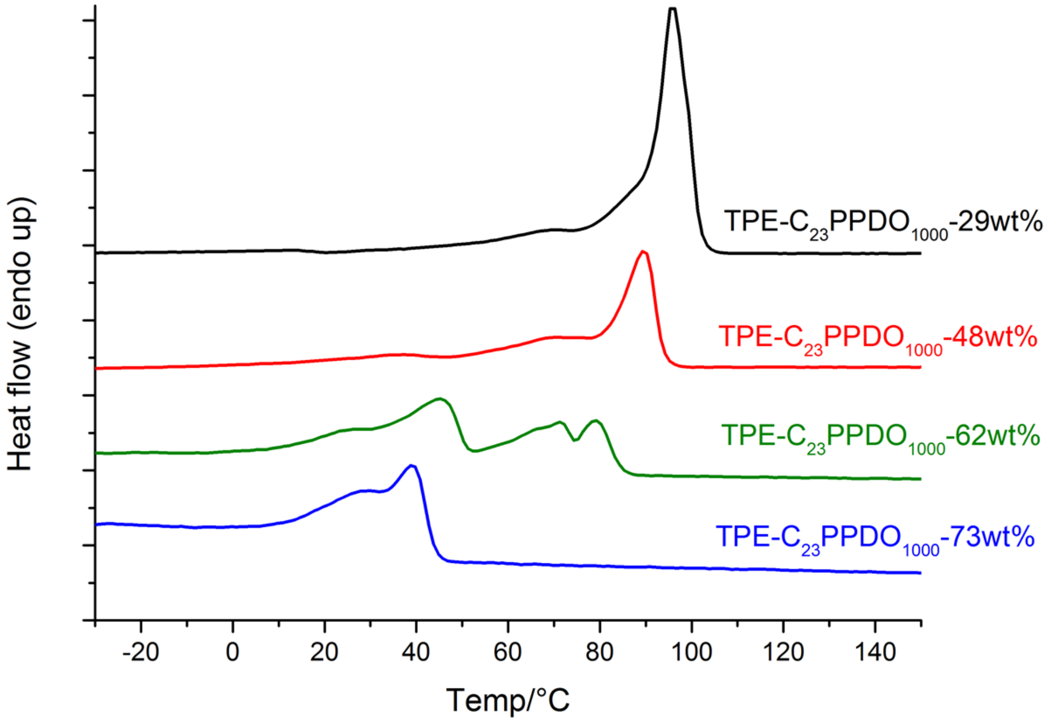

Figure S3. DSC thermograms (second heating) of polyester-polyether copolymers based on $PPDO_{1000}$

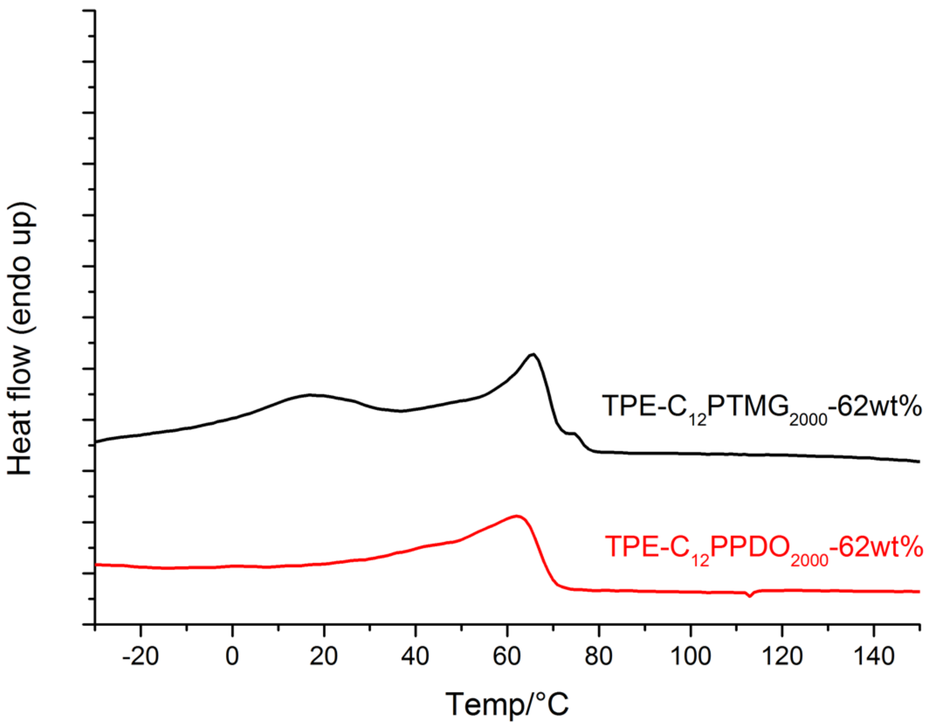

Figure S4. DSC thermograms (second heating) of polyester-polyether copolymers based on C_{12} monomers

Table S1. Polyester-polyether copolymers based on dodecanedioic acid and dodecanediol.

Entry		mol-% polyether diol of total diol	M_n[a]	M_w/M_n[a]	T_m[b]	T_c[b]
			[g mol^{-1}]		[°C]	[°C]
1	TPE-C_{12}PTMG$_{2000}$-62wt%	29% PTMG$_{2000}$	5.5 x 10^4	1.9	17/66	1/45
2	TPE-C_{12}PPDO$_{2000}$-62wt%	29% PPDO$_{2000}$	11.5 x 10^4	2.0	62	38

[a)]Determined by GPC in THF at 50 °C *versus* polystyrene standards. [b)]Determined by DSC with a heating/cooling rate of 10 K min^{-1}.

2. Tensile testing

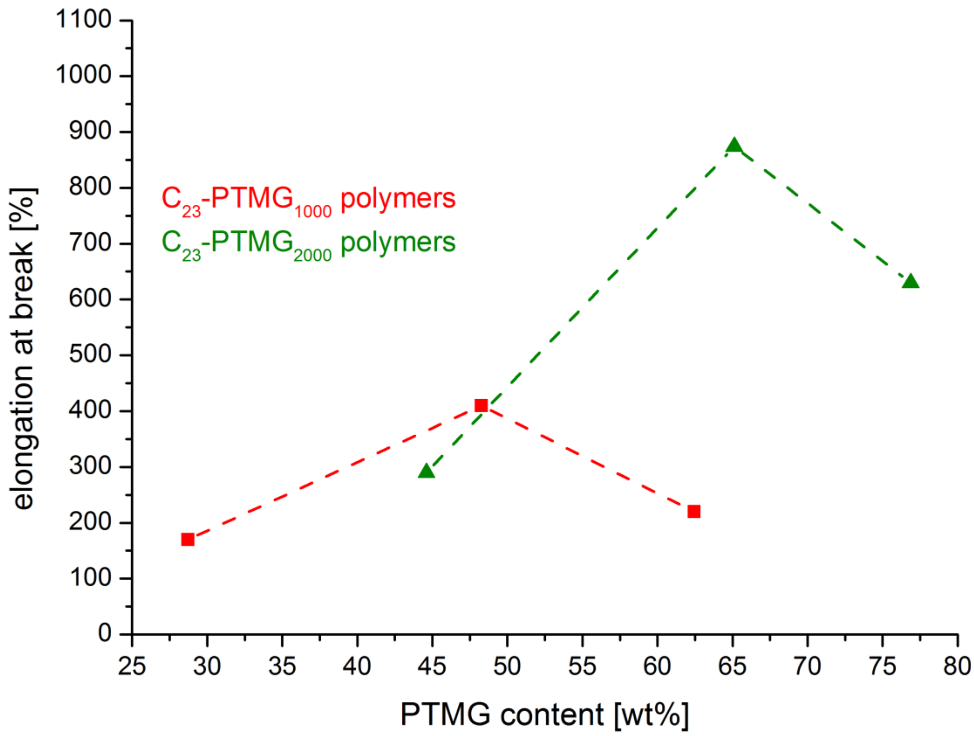

Figure S5. Elongation at break of PTMG copolymers (crosshead speed of 50 mm min^{-1}).

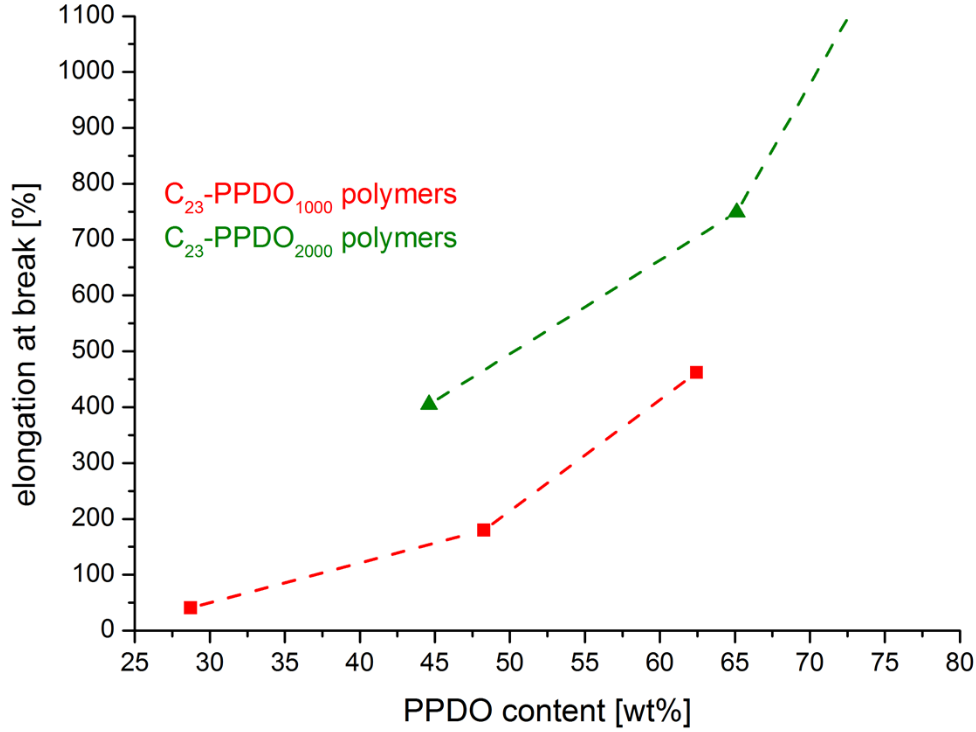

Figure S6. Elongation at break of PPDO copolymers (crosshead speed of 500 mm min^{-1}).

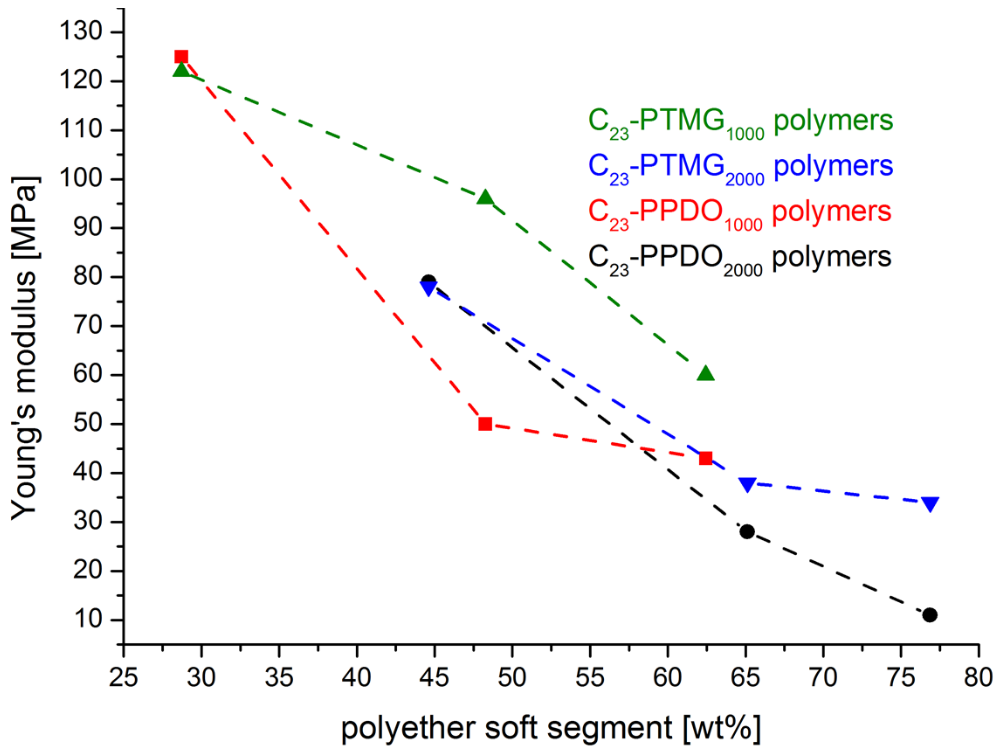

Figure S7. Correlation of Young moduli and polymer composition.

Table S2. Mechanical properties of polyester-polyether copolymers based on dodecanedioic acid and dodecanediol.[a]

Entry		mol-% polyether diol of total diol	Young modulus[b]	ε_b[c]	ε_b[d]	Permanent set[e]
			[MPa]	[%]	[%]	[%]
1	TPE-C_{12}PTMG$_{2000}$-62wt%	29% PTMG$_{2000}$	42	880	-	25
2	TPE-C_{12}PPDO$_{2000}$-62wt%	29% PPDO$_{2000}$	22	-	240	22

[a] Tensile tests following ISO 527/1-2, specimen type 5A prepared by injection molding. [b] Crosshead speed 1 mm/min. [c] Crosshead speed 50 mm/min. [d] Crosshead speed 500 mm/min [e] determined from hysteresis experiments after 10 cycles at an elongation of 100%.

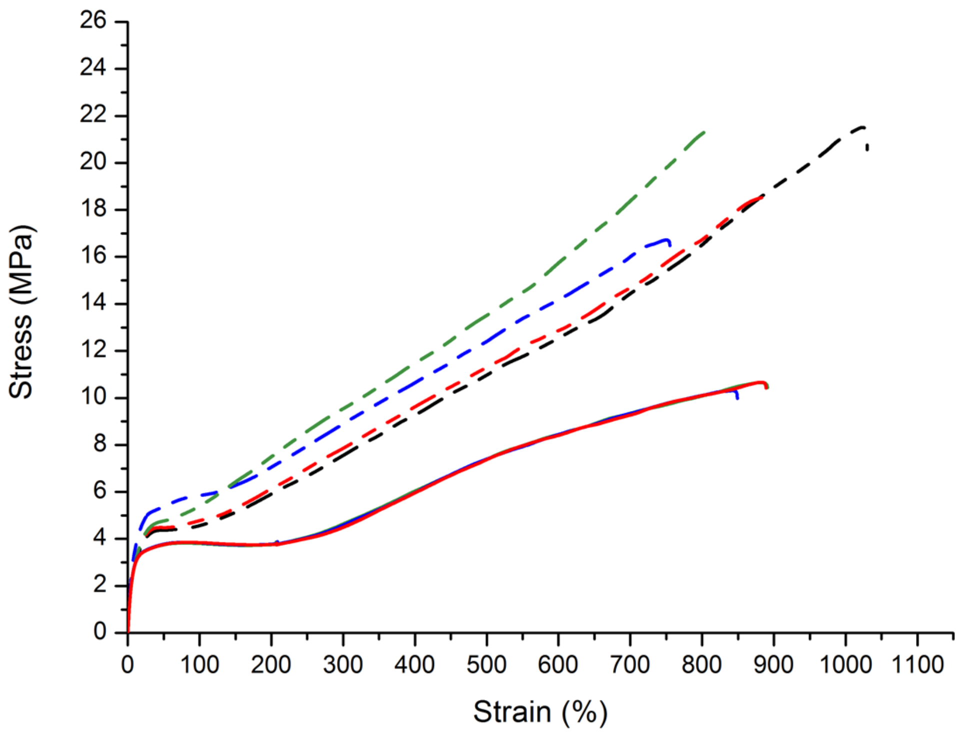

Figure S8. Stress-strain curves of polyester-polyether copolymer TPE-C_{23}PTMG$_{2000}$-65wt% (dashed line) and TPE-C_{12}PTMG$_{2000}$-62wt% (solid line).

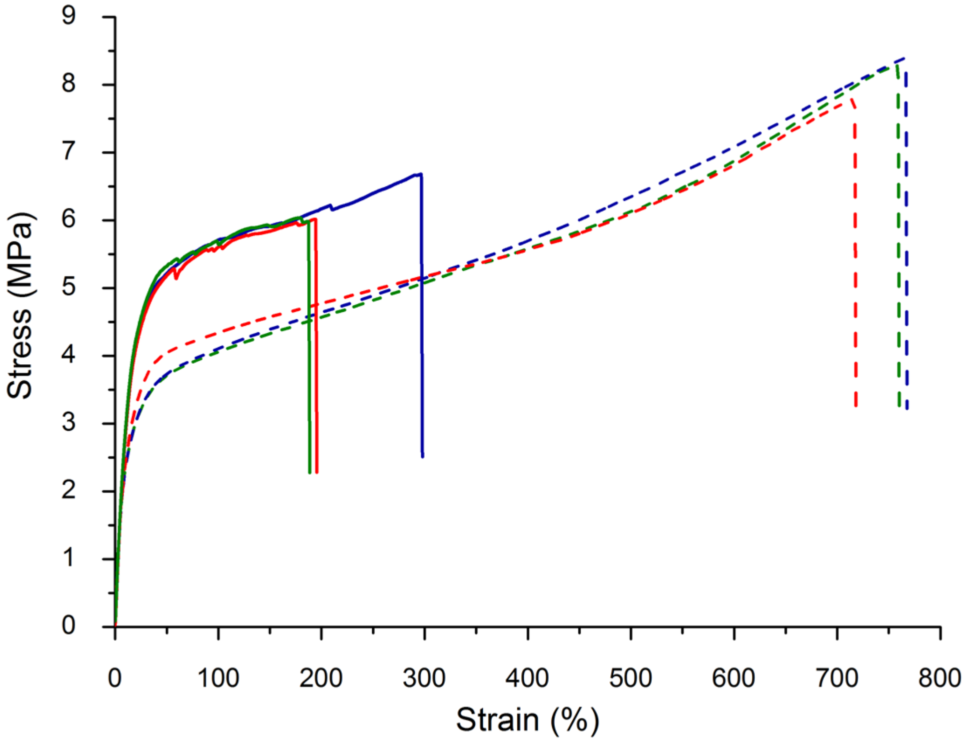

Figure S9. Stress-strain curves of polyester-polyether copolymer TPE-$C_{23}PPDO_{2000}$-65wt% (dashed line) and TPE-$C_{12}PPDO_{2000}$-62wt% (solid line).

4. Cyclic hysteresis tests

For preliminary shape recovery tests rectangular specimens (length × width × thickness = 60 × 10 × 1 mm^3) of polyester-polyether copolymer TPE-$C_{23}PTMG_{2000}$-65wt%, prepared via injection molding, were repeatedly exposed to a constant stress of about 5.6 MPa or extended to a defined elongation of ca. 80 % (c.f. **Figure S11**).

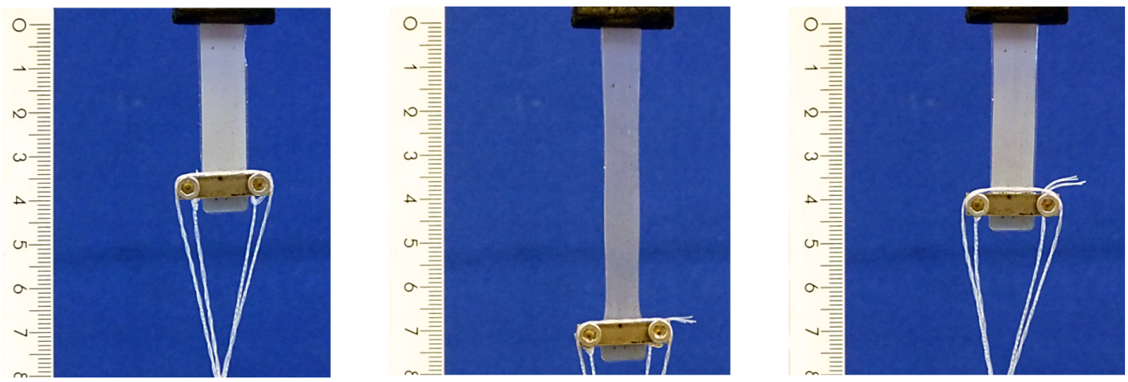

Figure S10. Shape recovery tests of polyester-polyether copolymer TPE-$C_{23}PTMG_{2000}$-65wt%.

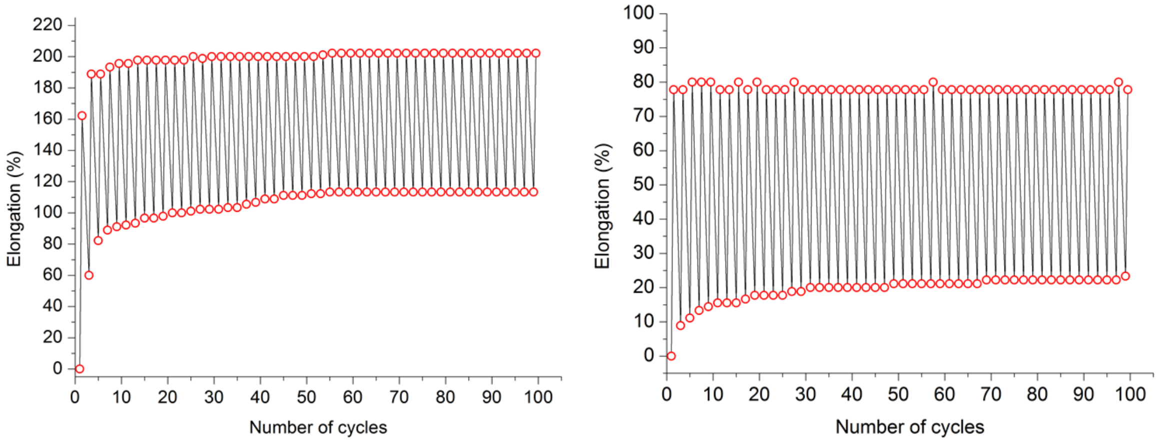

Figure S11. Shape recovery tests on polyester-polyether copolymer TPE-$C_{23}PTMG_{2000}$-65wt% applying constant stress of about 5.6 MPa (left) and a constant elongation of ca. 80 % (right) (for clarity only every second cycle is displayed).

Cyclic hysteresis tests on dogbone-shaped sample bars (75 × 12.5 × 2 mm3; ISO 527-2, type 5A) of polyester-polyether copolymers were performed on a Zwick 1446 Retroline tC II instrument. The test specimens were repeatedly exposed to consecutive cycles of loading and unloading to a constant strain of 100 % with a constant crosshead speed of 50 mm min^{-1}. The recovery was measured by observing the residual strain after 10 cycles.

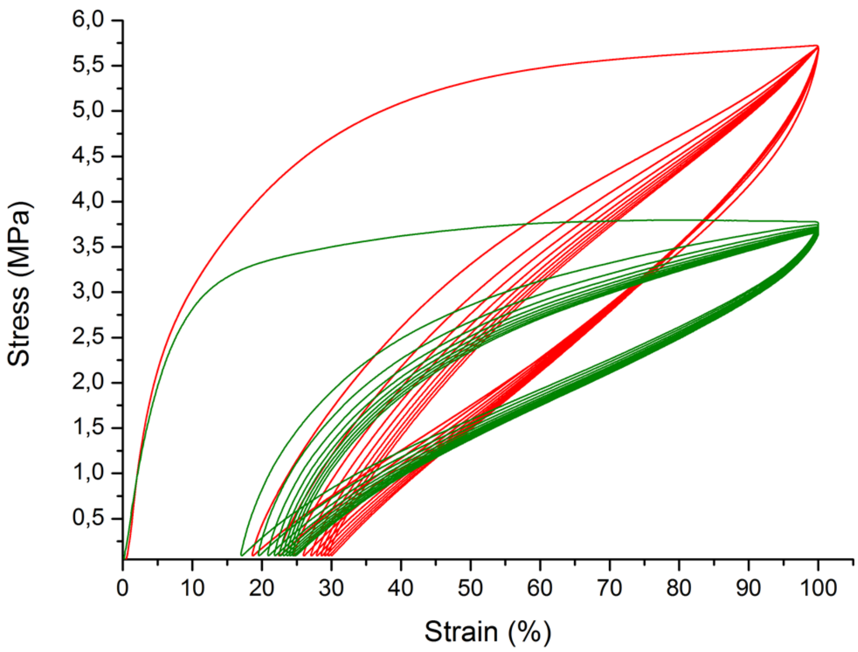

Figure S12. Stress-strain curves from cyclic tensile tests with a constant strain of 100 % for polyester-polyether copolymer TPE-$C_{23}PTMG_{2000}$-65wt% (red) and TPE-$C_{12}PTMG_{2000}$-62wt% (green) (10 cycles are displayed).

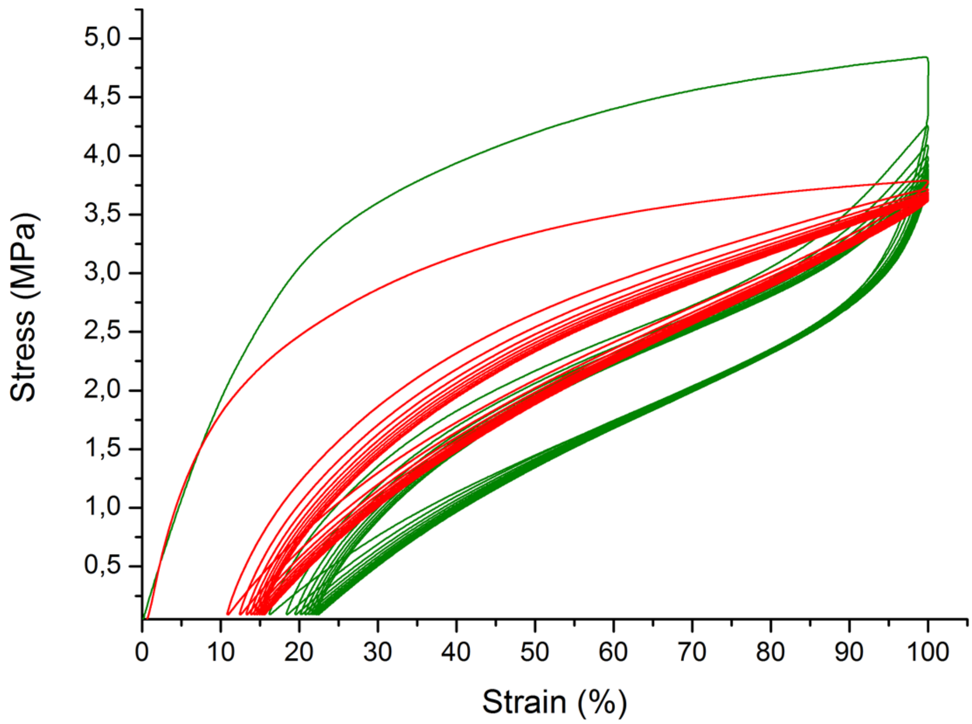

Figure S13. Stress-strain curves from cyclic tensile tests with a constant strain of 100 % for polyester-polyether copolymer TPE-$C_{23}PPDO_{2000}$-65wt% (red) and TPE-$C_{12}PPDO_{2000}$-62wt% (green) (10 cycles are displayed).

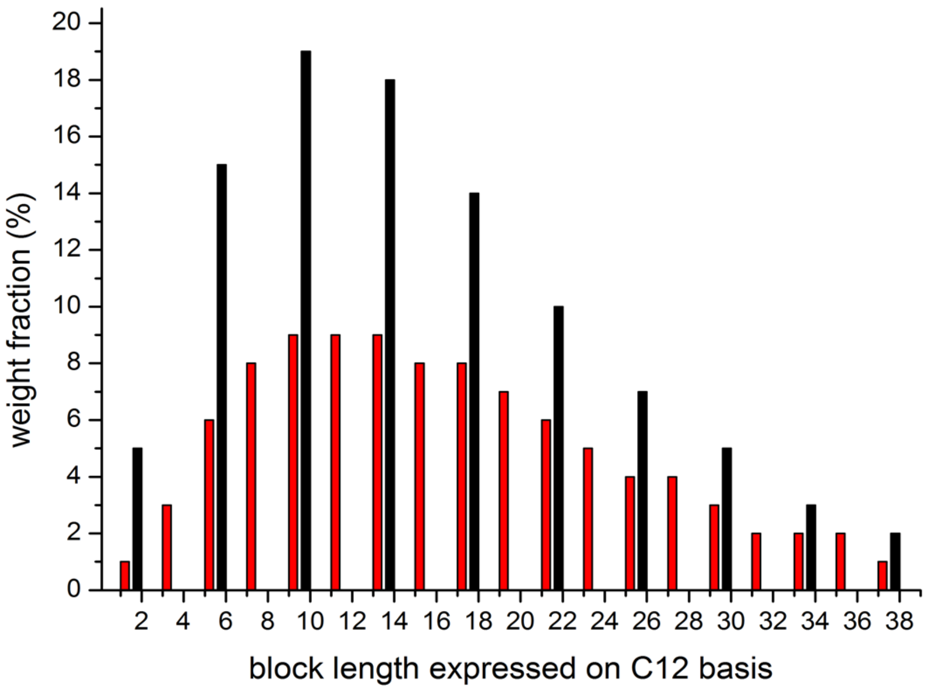

Figure S14. Block lengths distributions expressed on C_{12}-basis for copolyester of C_{24} dicarboxylic acid with C_{24} diol and 25 mol% polyether (black) and for copolyester of C_{12} dicarboxylic acid with C_{12} diol and 14.3 mol% polyether (red), i.e. isolated acid repeat unit: n =1 (C_{12}) and n = 2 (C_{24}); acid- aliph. diol-acid: n = 3 (C_{12}) and n = 6 (C_{24}) etc.

5. NMR spectroscopy

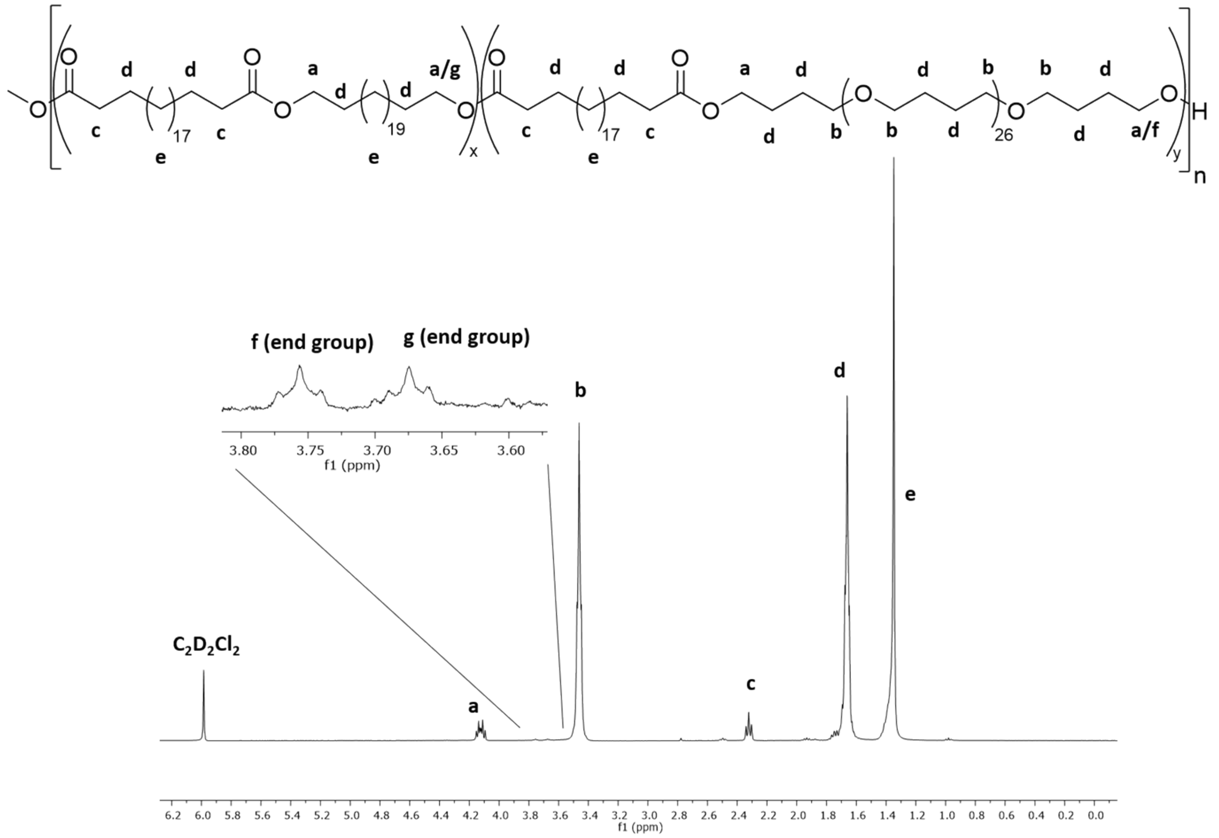

Figure S15. ^{1}H NMR ($C_2D_2Cl_2$, 130°C) of TPE-C_{23}PTMG$_{2000}$-65wt%

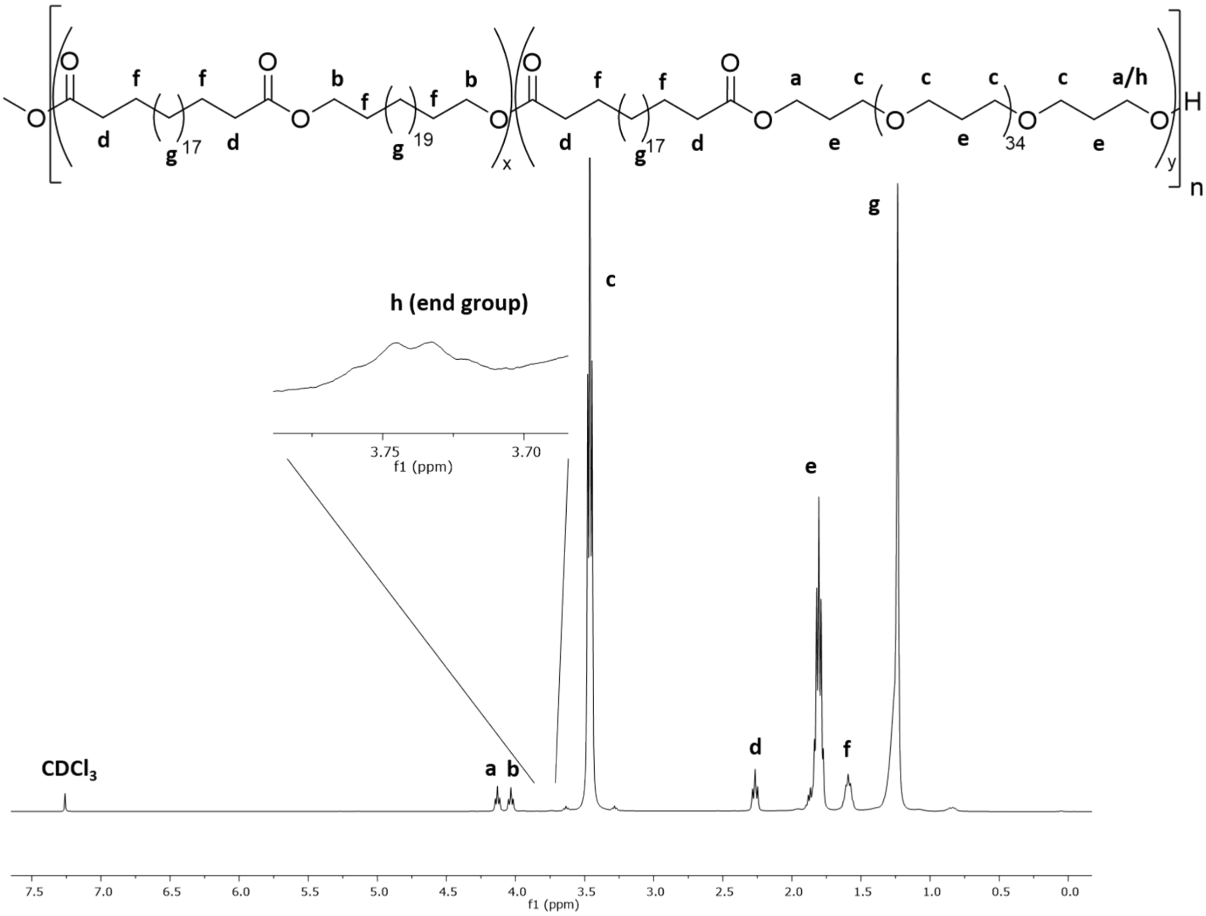

Figure S16. ^{1}H NMR ($CDCl_3$, 25°C) of TPE-C_{23}PPDO$_{2000}$-65wt%