

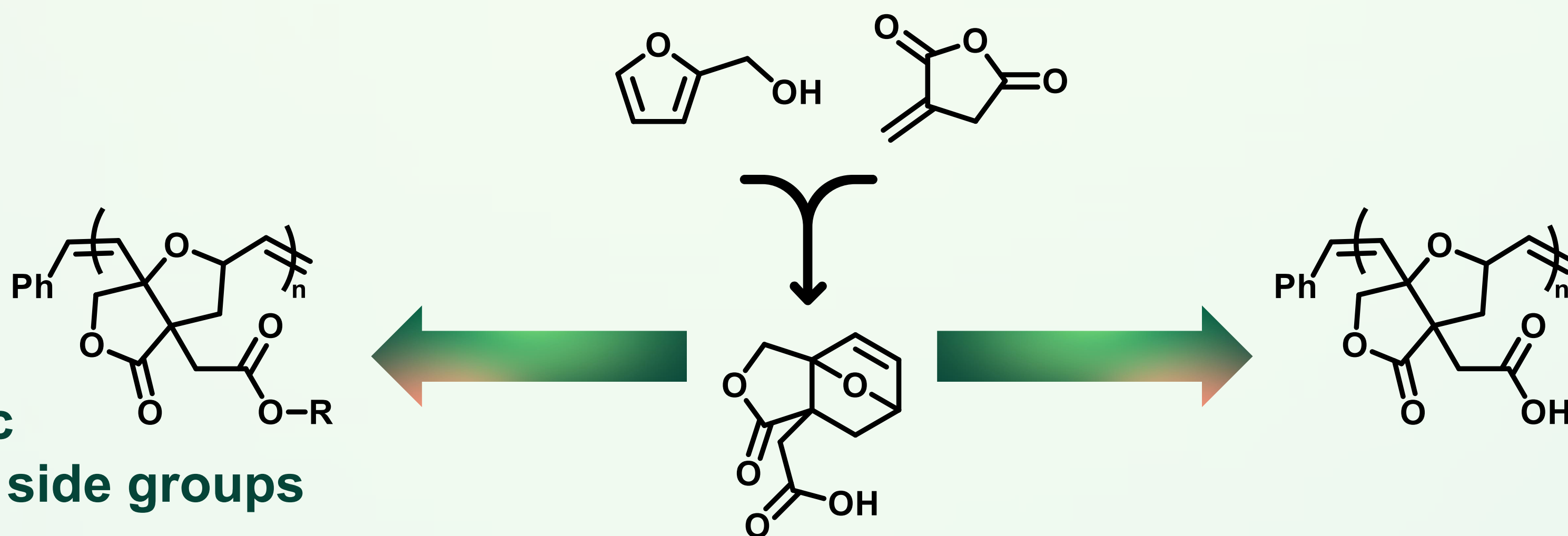
Sustainable polymers by ring-opening metathesis polymerisation derived from bio renewable monomers

Lucas Al-Shok, Kirsten Hawkins, Antoine Buchard*

*Green Chemistry Centre of Excellence, University of York, Department of Chemistry, Heslington, York YO10 5DD

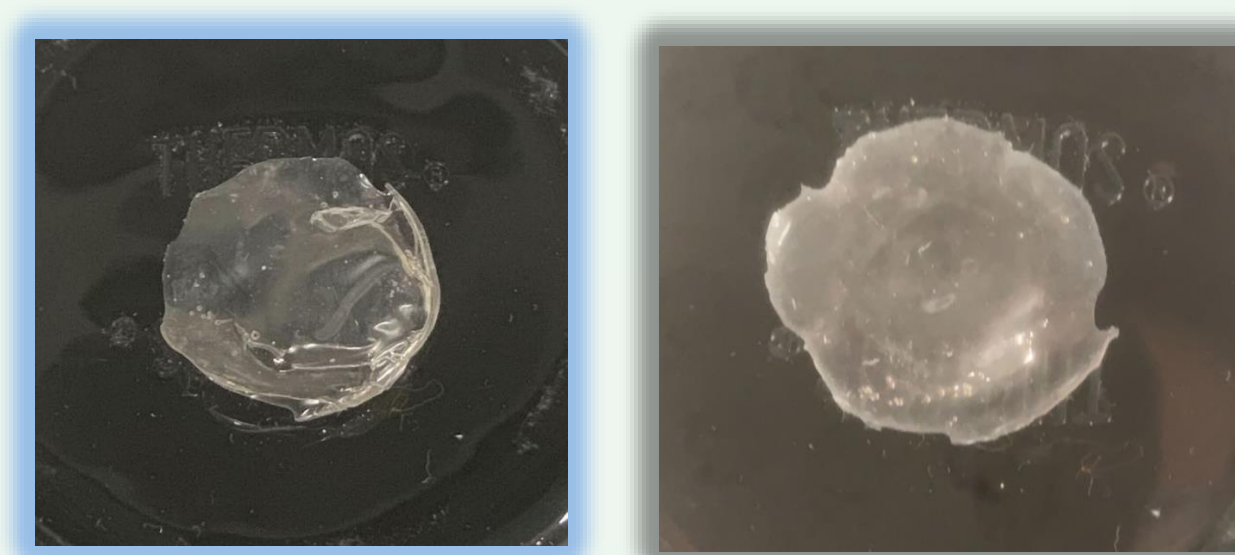
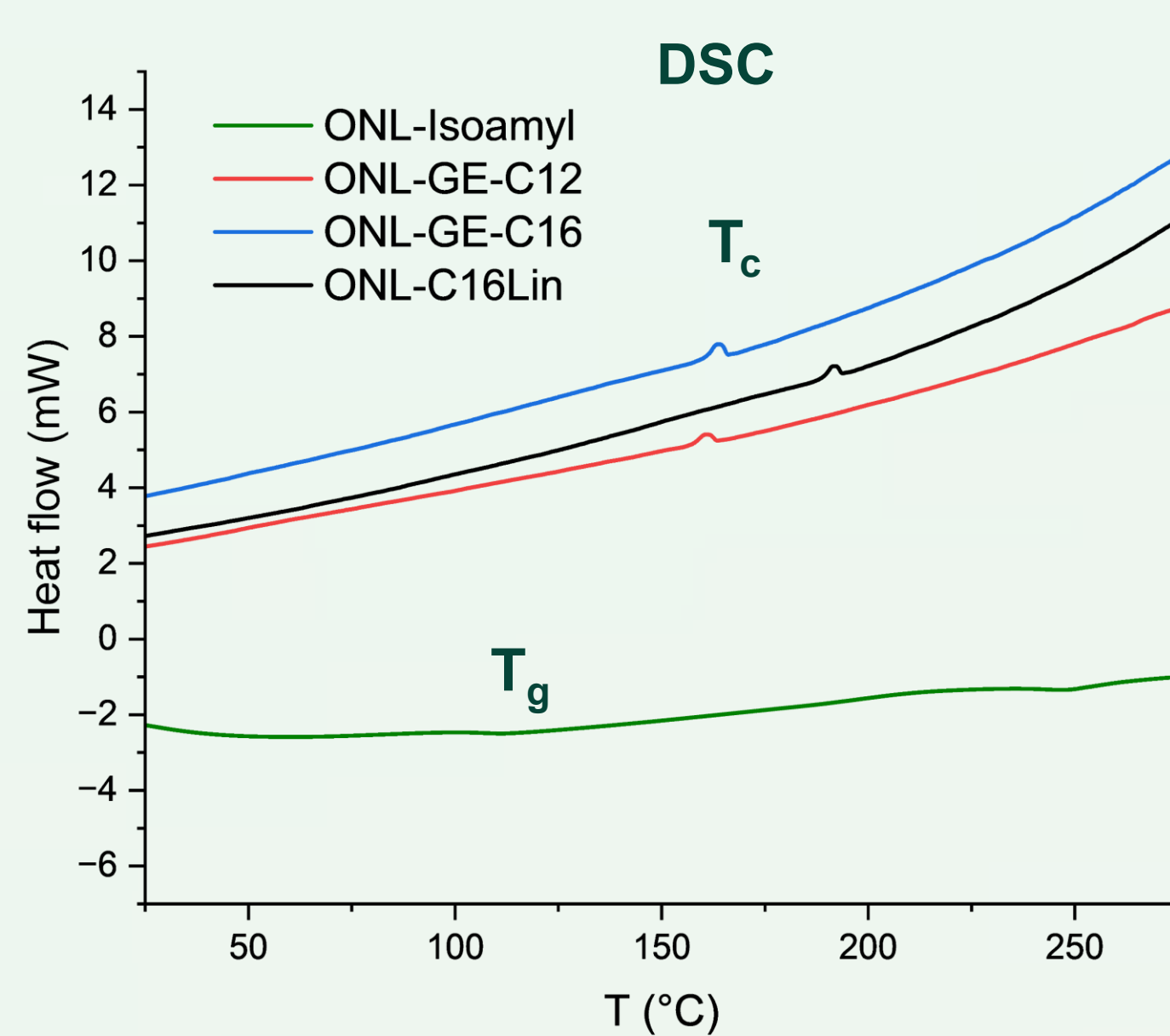
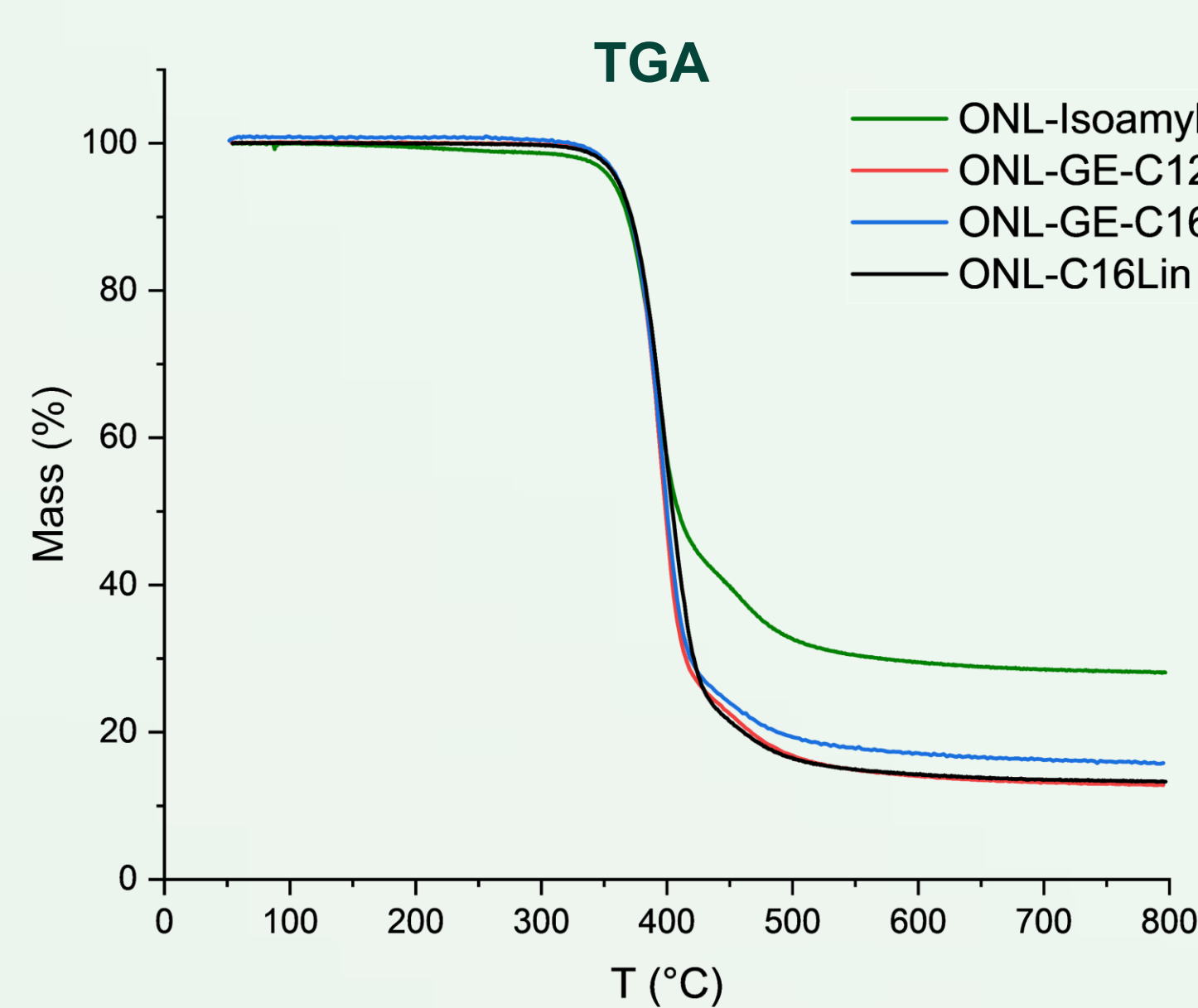
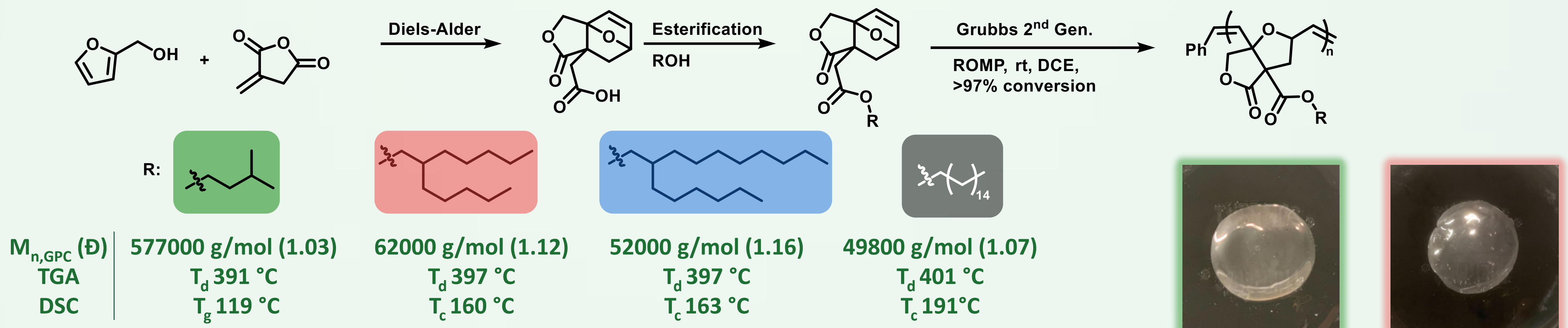


- Hydrophobic
- Tuning alkyl side groups
- Films



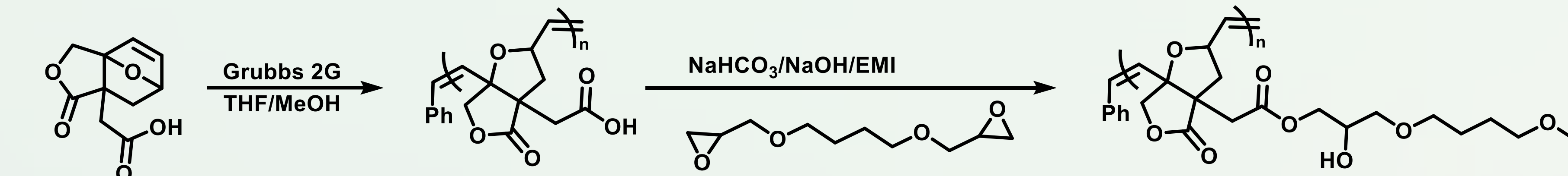
- Hydrophilic
- Crosslinking
- Hydrogels

Synthesis & polymerisation



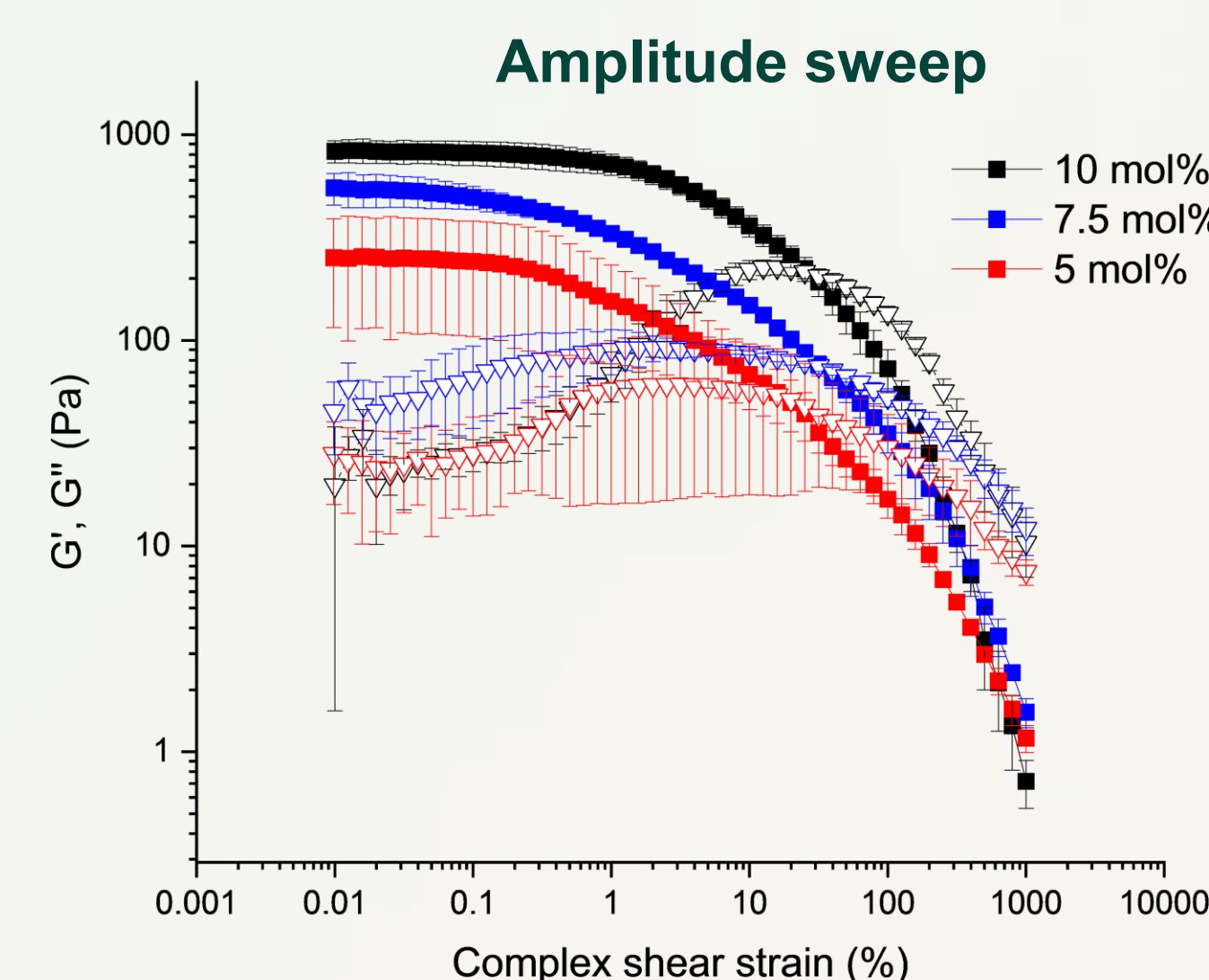
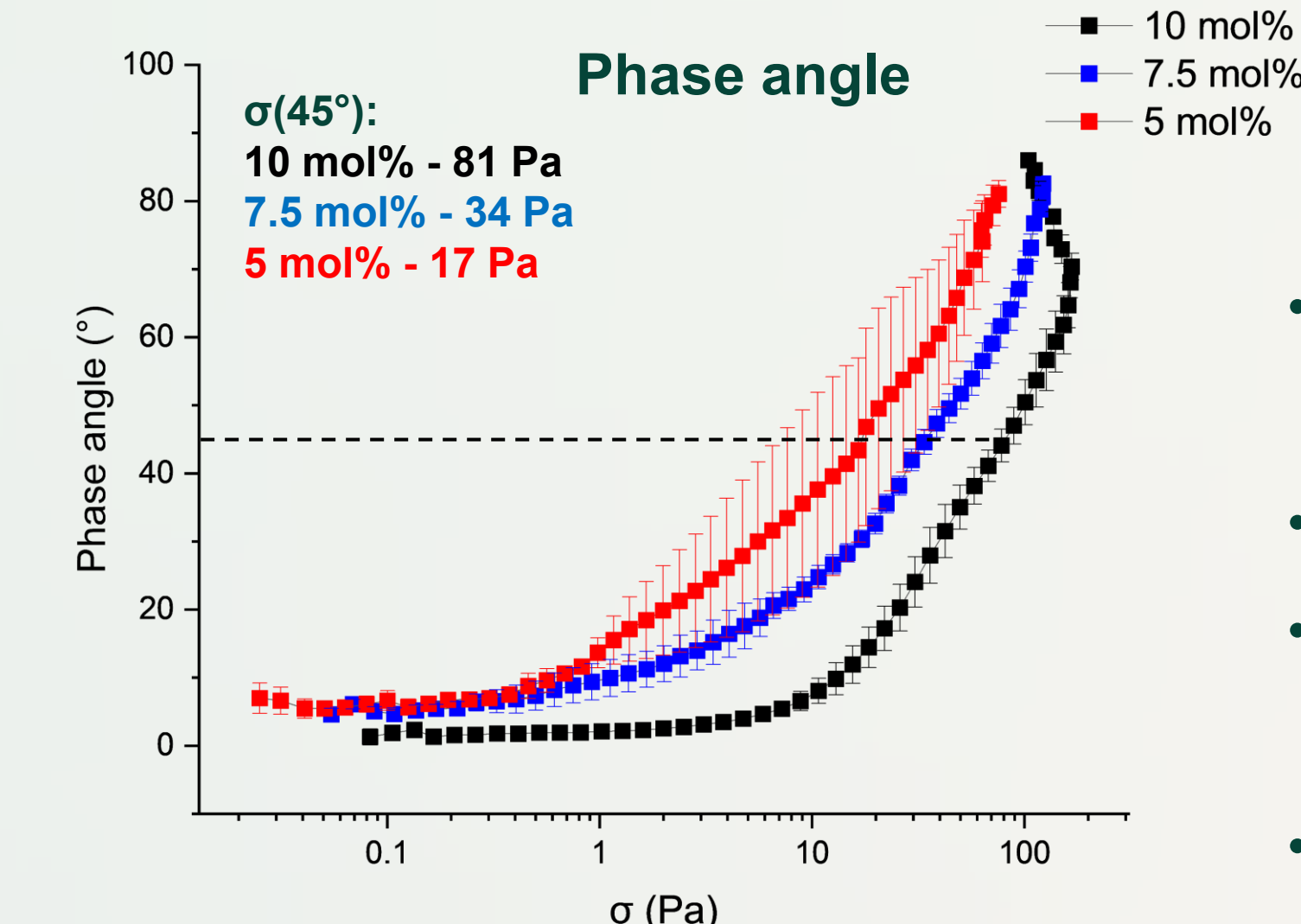
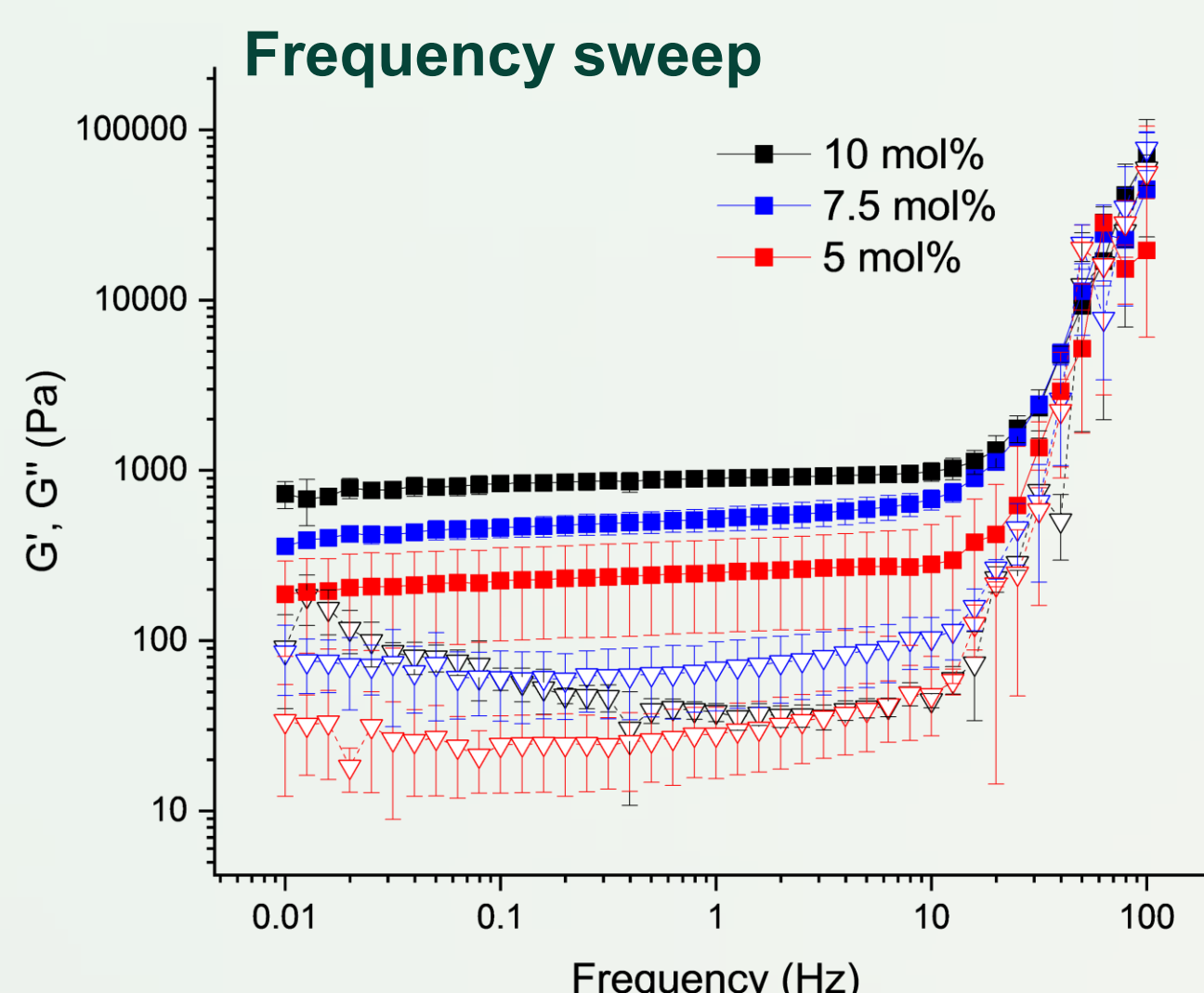
- Film *via* solvent casting from chloroform
- Slight increase in T_d and T_c with longer linear chain
- Low intensity thermal transitions

Post-polymerisation modification



Monomer 1	Monomer 2	DP _{target}	conversion [%]	M _{n,theo} [g/mol]	M _{n,GPC} [g/mol] (Đ)
ONL-H		200	84	33100	73600 (3.21)
ONL-H		10	93	1800	2700 (1.52)
ONL-H		100	90	17600	69800 (2.88)
ONL-H		100	98	19300	69500 (2.60)
ONL-H		300	50	29400	84600 (2.67)
ONL-H		300	89	52300	153000 (3.18)
ONL-H		100	87	16900	47100 (1.83)
ONL-H		300	75	44600	29700 (1.32)
ONL-H		500	96	93700	51700 (1.92)
ONL-H	ONL-GE-C12	100:100	93	51900	18600 (2.47)

Catalyst	T [°C]	Polymer concentration [wt%]	Crosslinker [mol%]	Gel
EMI (0.75 eq)	80	14.5	10	Y
NaHCO ₃ (0.75 eq)	80	14.5	10	Y
NaOH (0.75 eq)	80	14.5	10	Y
EMI (0.75 eq)	50	13	10	Y
EMI (0.75 eq)	80	10	10	Y
EMI (0.75 eq)	80	8	10	N
EMI (0.75 eq)	80	12	10	Y
Ca(OH) ₂ (0.75 eq)	80	12	/	N
EMI (0.75 eq)	80	12	10	Y
EMI (0.75 eq)	80	12	10	N
EMI (0.75 eq)	80	12	10	Y
EMI (0.75 eq)	50	12	10	Y
EMI (0.75 eq)	80	12	20	Y
EMI (0.75 eq)	80	12	50	Y
EMI (0.75 eq)	80	12	75	Y
EMI (0.75 eq)	80	12	5	Y
EMI (0.75 eq)	80	12	1	N
EMI (0.75 eq)	80	12	7.5	Y



- Increasing crosslinker amount → Increasing elastic proportion of the gel
- no trend in crossover point
- Phase angle 45° → increased gel stability with increased crosslinker amount
- Trend does not continue for CL >10 mol%

Outlook

- Expand on ONL derivatives
- Molecular weight ↔ Thermal/Rheological properties

- Optimisation of ONL-H polymerisation with protecting group chemistry
- Copolymerisation

References

- [1] Y. Bai, Mario De Bruyn, J. H. Clark, J. R. Dodson, T. J. Farmer, M. Honoré, I. D. V. Ingram, M. Naguib, A. C. Whitwood, M. North, *Green Chemistry*, **2016**, *18*, 3945.
- [2] Y. Bai, J. H. Clark, T. J. Farmer, I. D. V. Ingram, M. North, *Polymer Chemistry*, **2017**, *8*, 3074.