

Mellitic Anhydride-Based Dynamic Polyester Networks

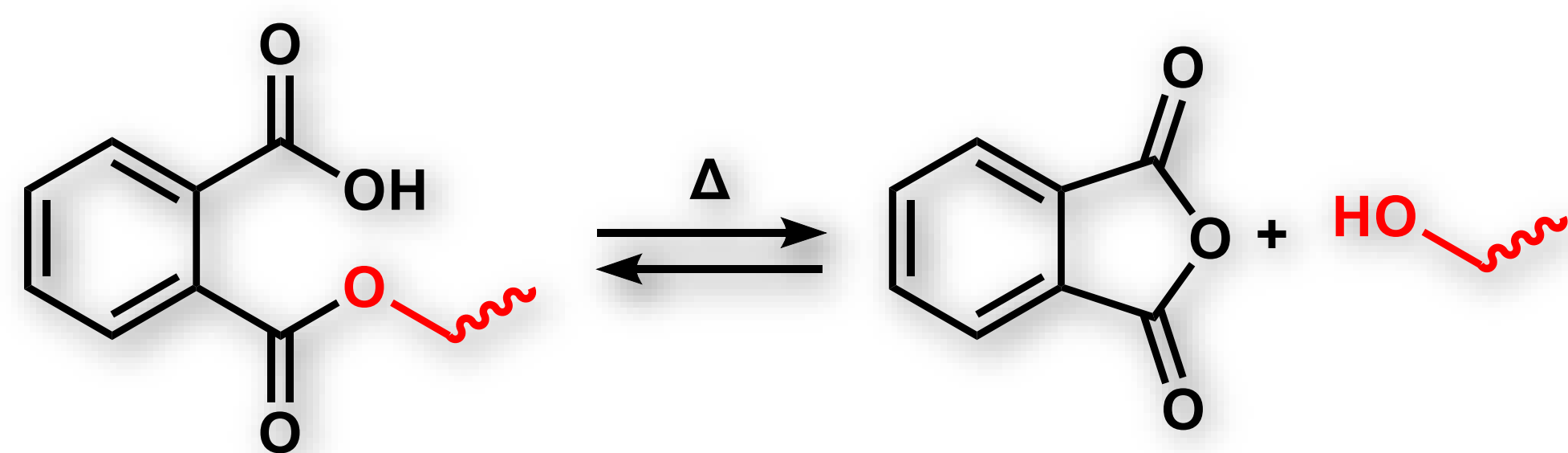
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Introduction

Phthalate monoester dynamic chemistry

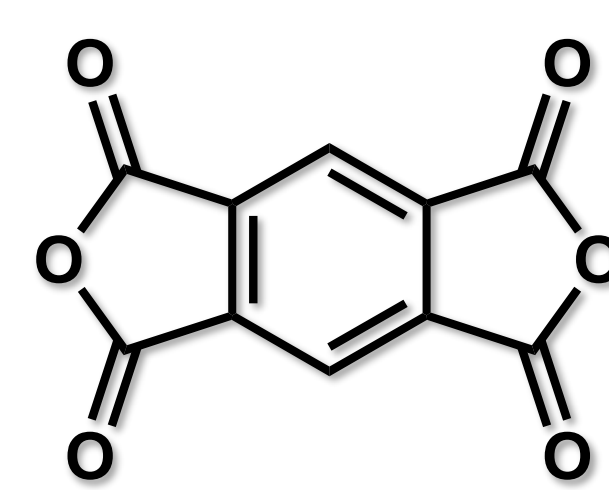


○ No external catalysis

○ Neighbouring group participation

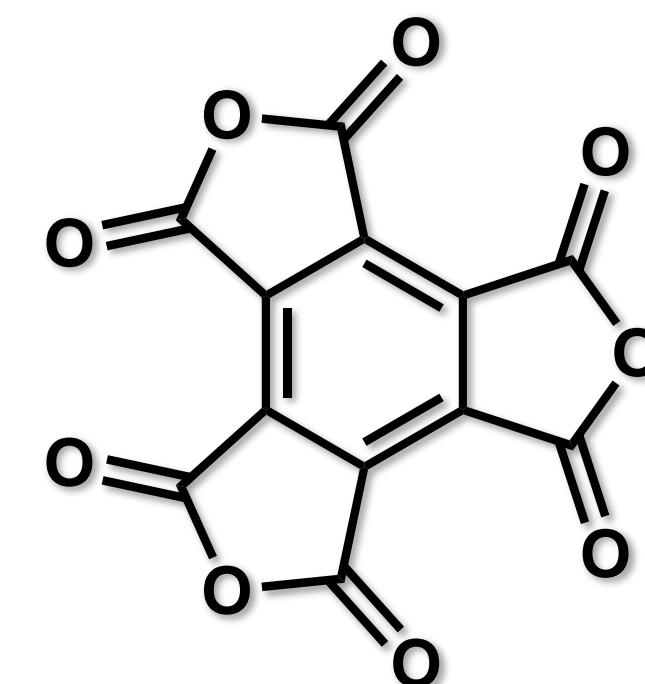
✗ Irreversible bond formation at elevated $T \rightarrow$ loss in dynamicity

Previous studies^{1,2}



PMDA
= dynamic *linker*

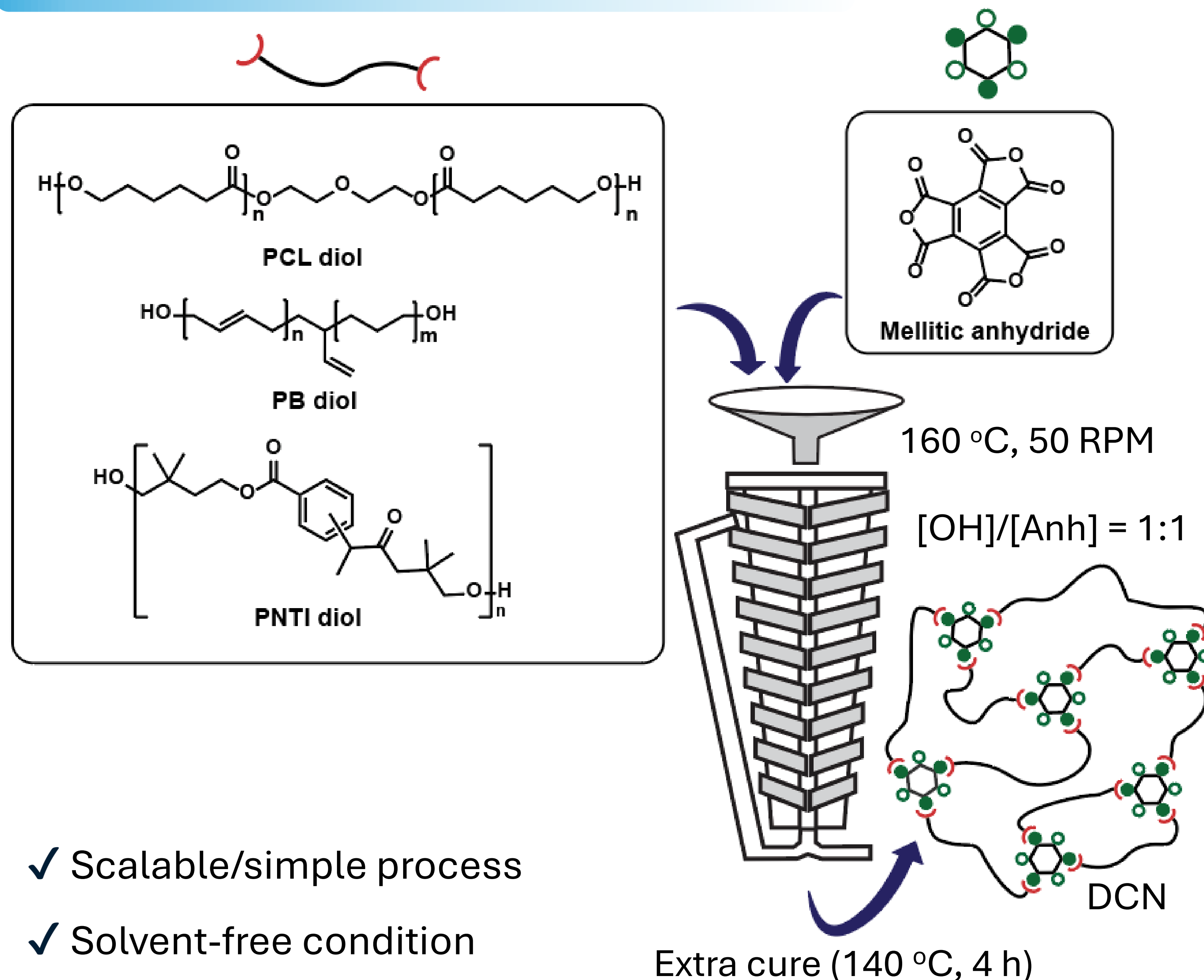
This work



MA
= dynamic *cross linker*

Results and Discussion

Polyester network preparation

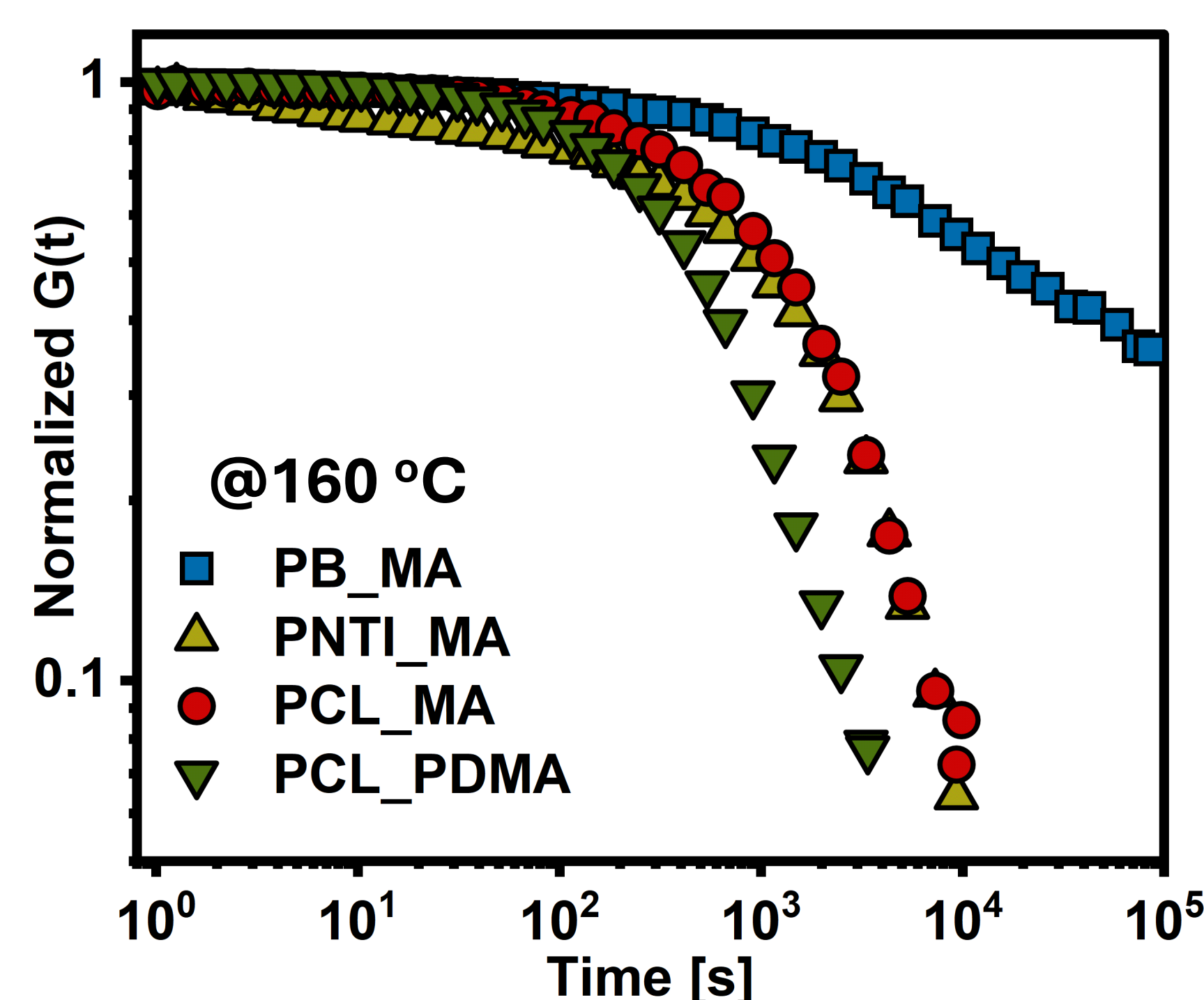


- ✓ Scalable/simple process
- ✓ Solvent-free condition
- ✓ Thermoplastics \rightarrow DCN
- ✓ Various backbone choices (diol prepolymer)
- ✓ Reactive extrusion as a cross-linking method

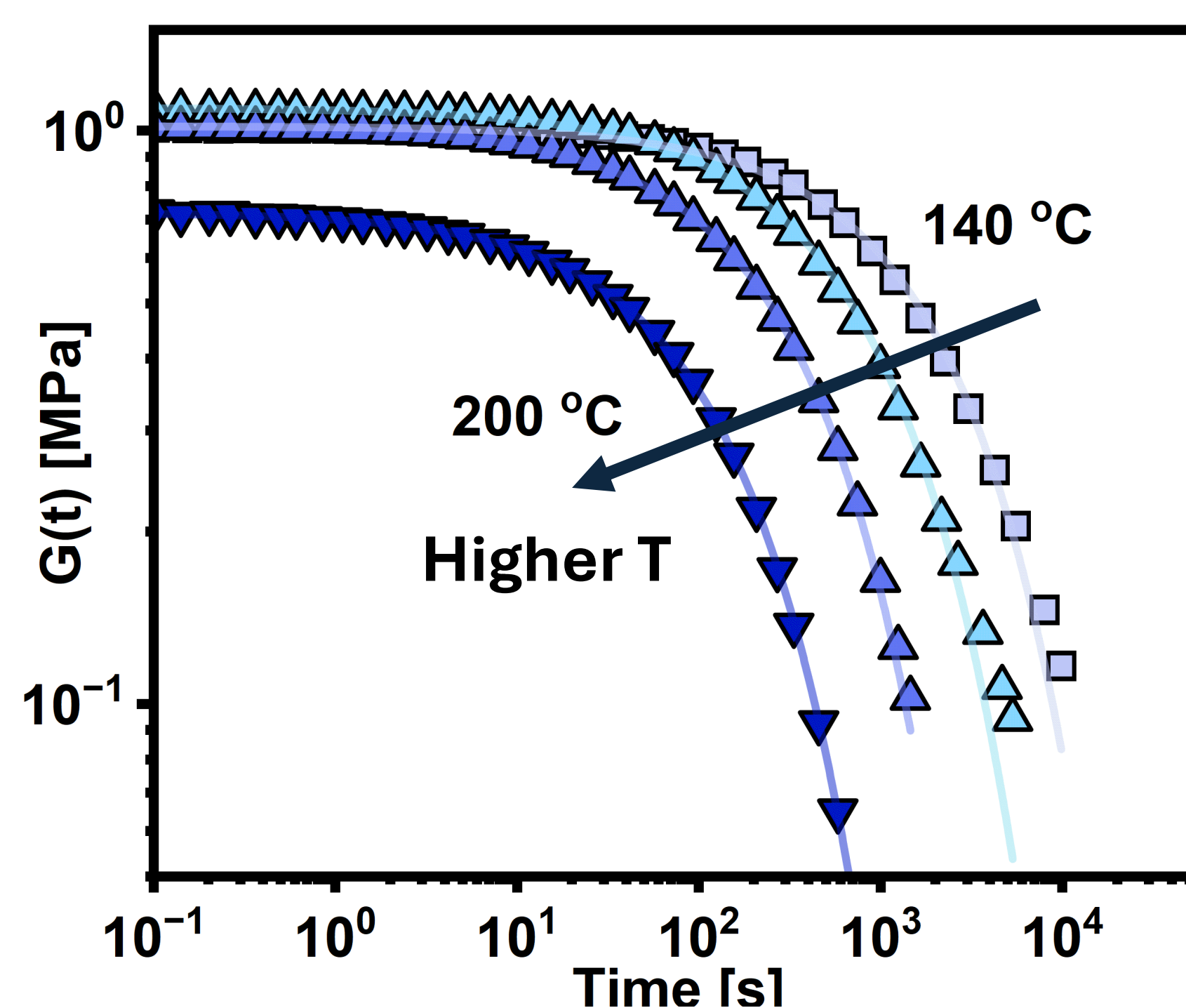
DCN	Used polyol	Gel fraction
PNTI-MA	PNTI diol ($M_n = 4,000$ g/mol)	1.0
PB-MA	PB diol ($M_n = 2,100$ g/mol)	1.0
PCL-MA	PCL diol ($M_n = 2,000$ g/mol)	0.93
PCL-PMDA	PCL triol ($M_n = 2,000$ g/mol)	0.98

Stress relaxation behavior

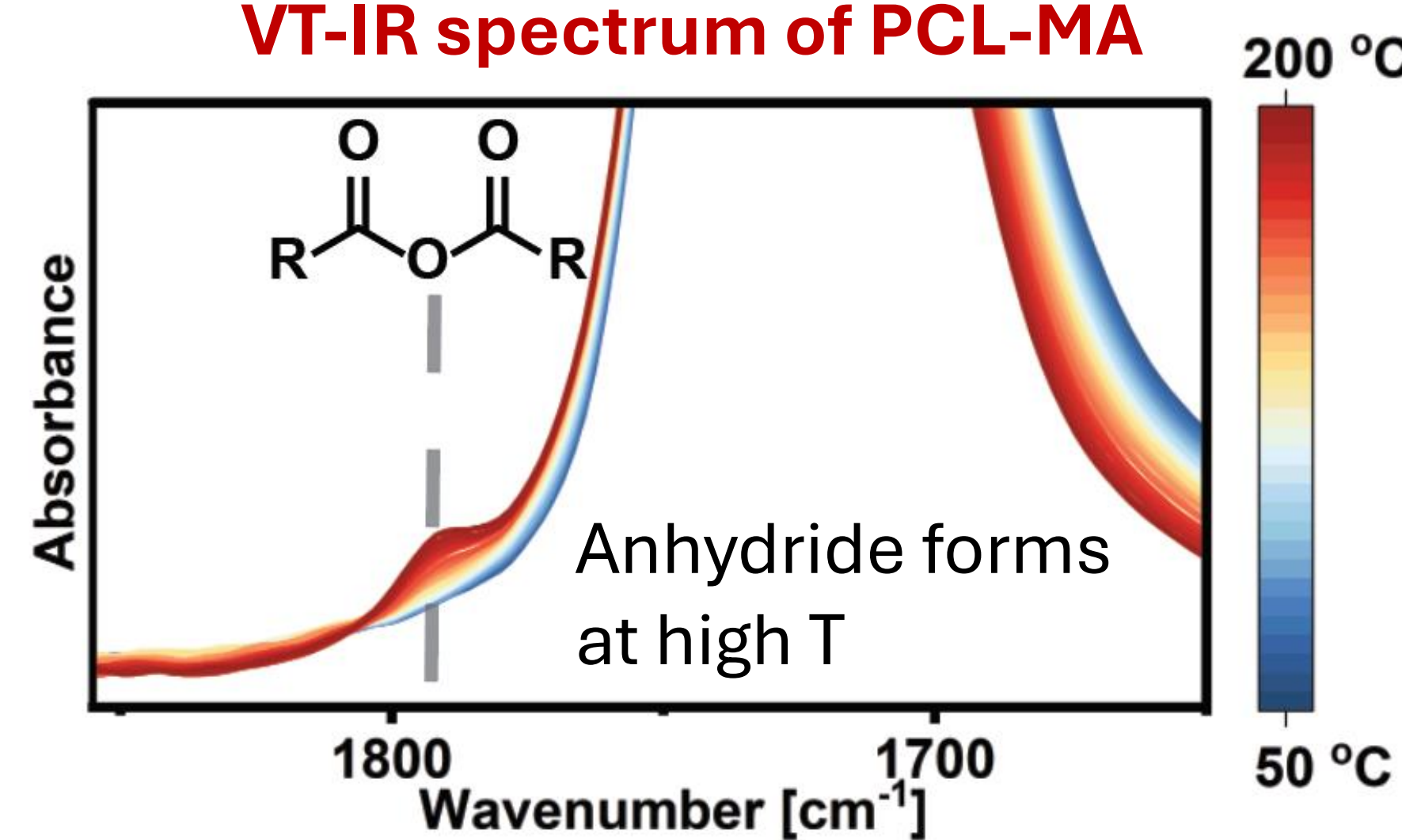
Influence of backbones/dynamic motif



Stress relaxation of PCL-MA

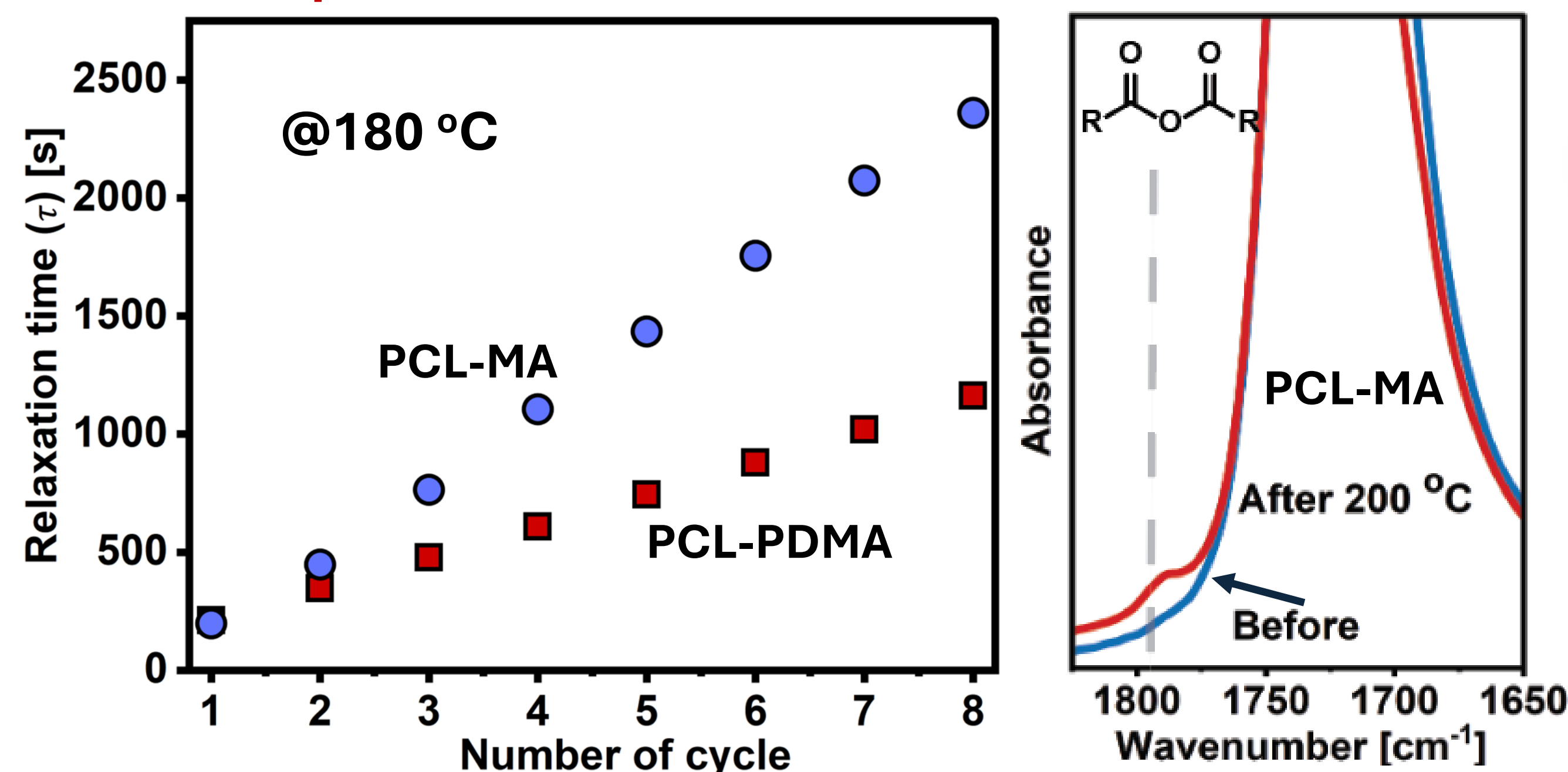


VT-IR spectrum of PCL-MA

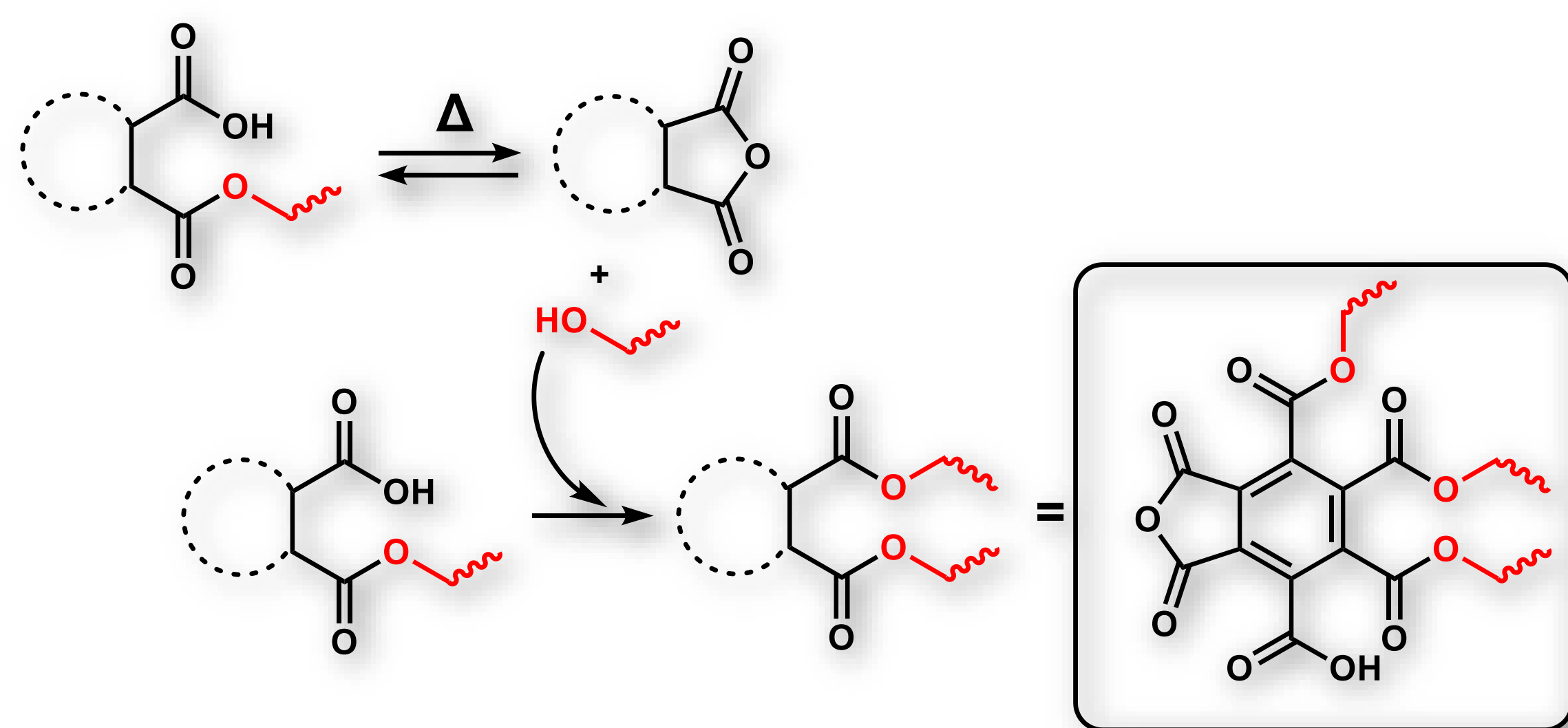


Persistence of dynamic properties

Repeated stress relaxations



Secondary esterification



Plausible structure of reduced dynamic motifs

Conclusions

- Successful DCN preparation via reactive extrusion
- MA is an effective dynamic cross linker
- MA suffers more from side reactions than PMDA

References

1. H. Zhang *et al.*, *ACS Macro Lett.*, **9**, 272 (2020).
2. M. Delahaye *et al.*, *J. Am. Chem. Soc.*, **141**, 15277 (2019).

Acknowledgements

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