

Fast Scanning Calorimetry: Application towards Polymers

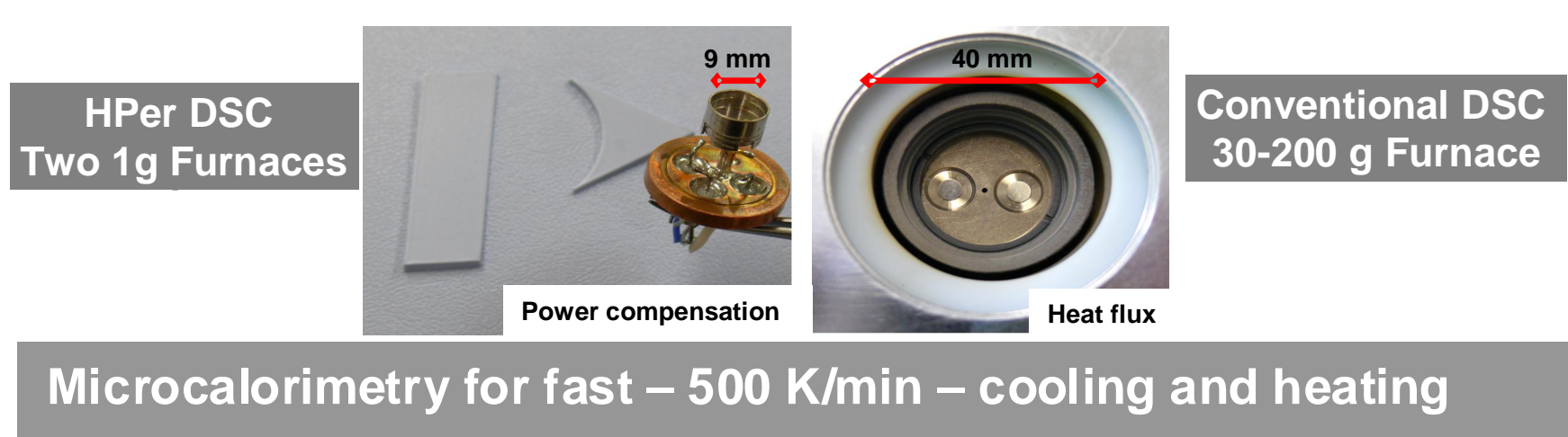
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Sharing knowledge...

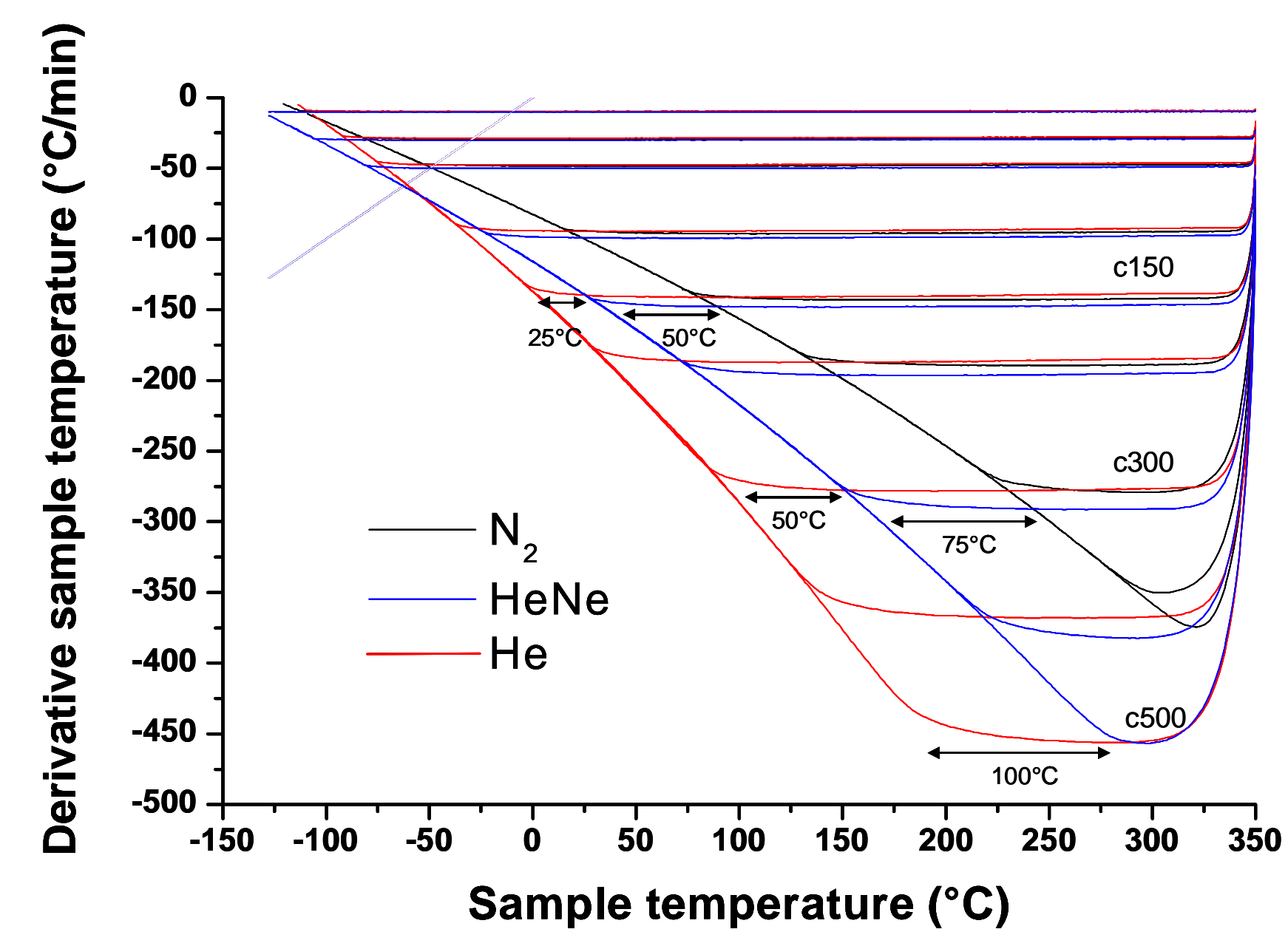
1. Introduction

Fast-scan calorimeters (FSC) — and especially High Performance DSC (HPer DSC; and its commercial equal: HyperDSC [1]); the RHC [2] and the chip-calorimeter [3]) — have received a great deal of attention in recent years. The reason that it is becoming increasingly popular is because, firstly, in practice, some physical and chemical processes occur at much higher scan rates than realizable using Standard DSC; and, secondly, most nano-structures in materials and substances, including polymers and pharmaceuticals, are in metastable states.

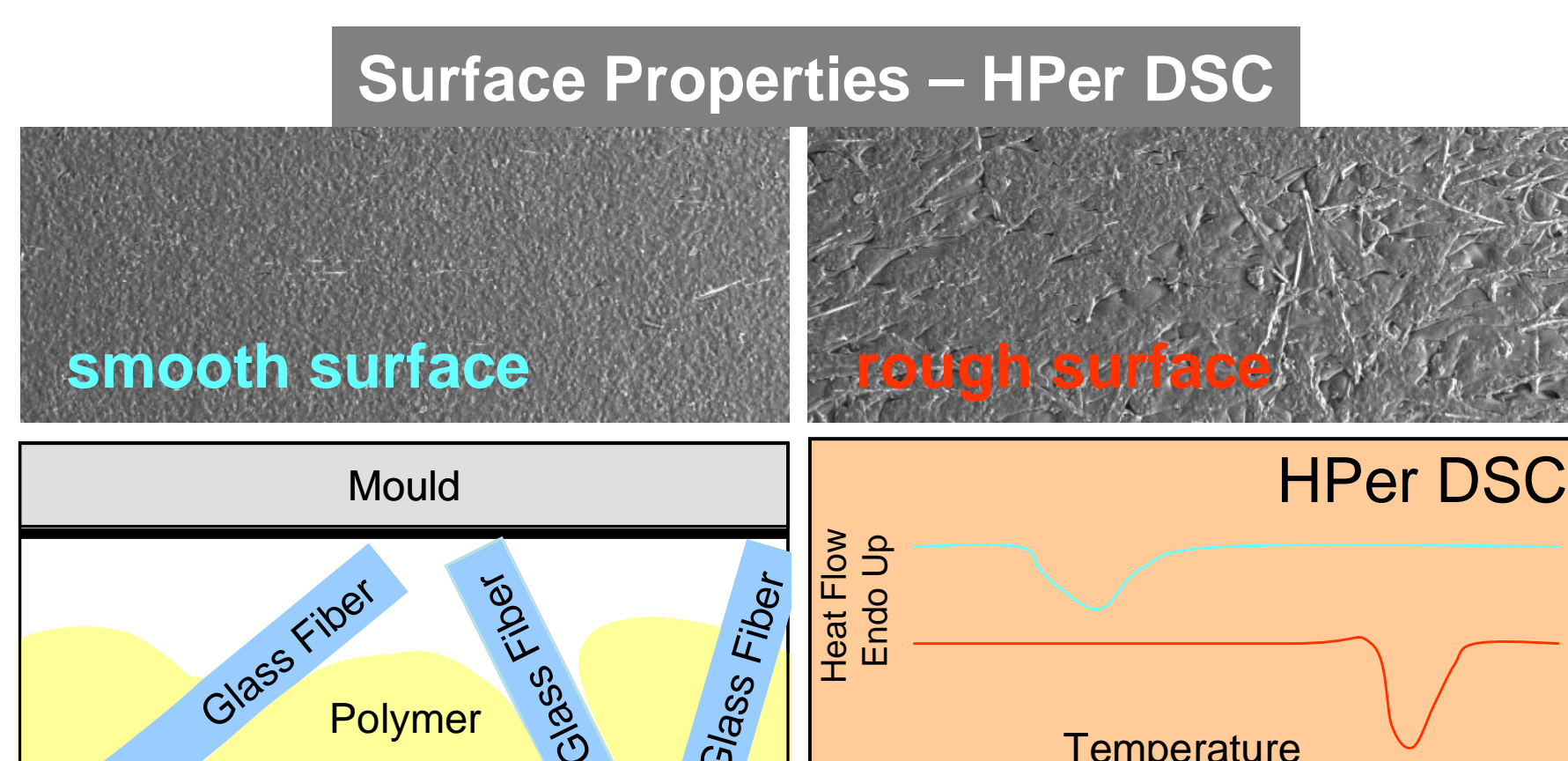
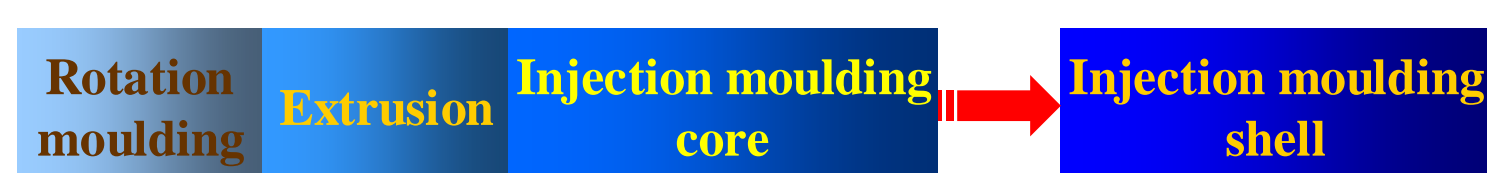
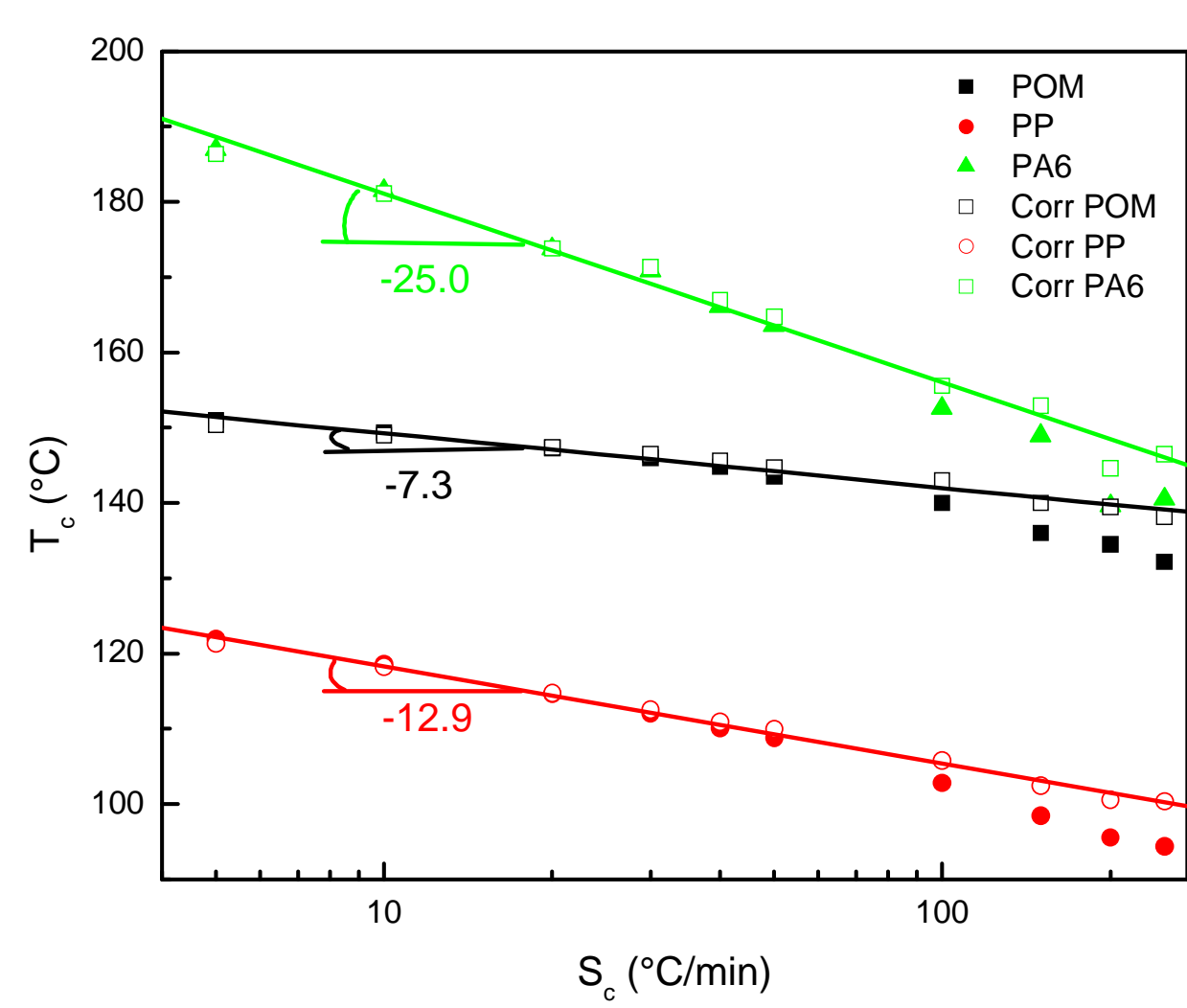
2. High Performance DSC (HPer DSC)



3. Performance

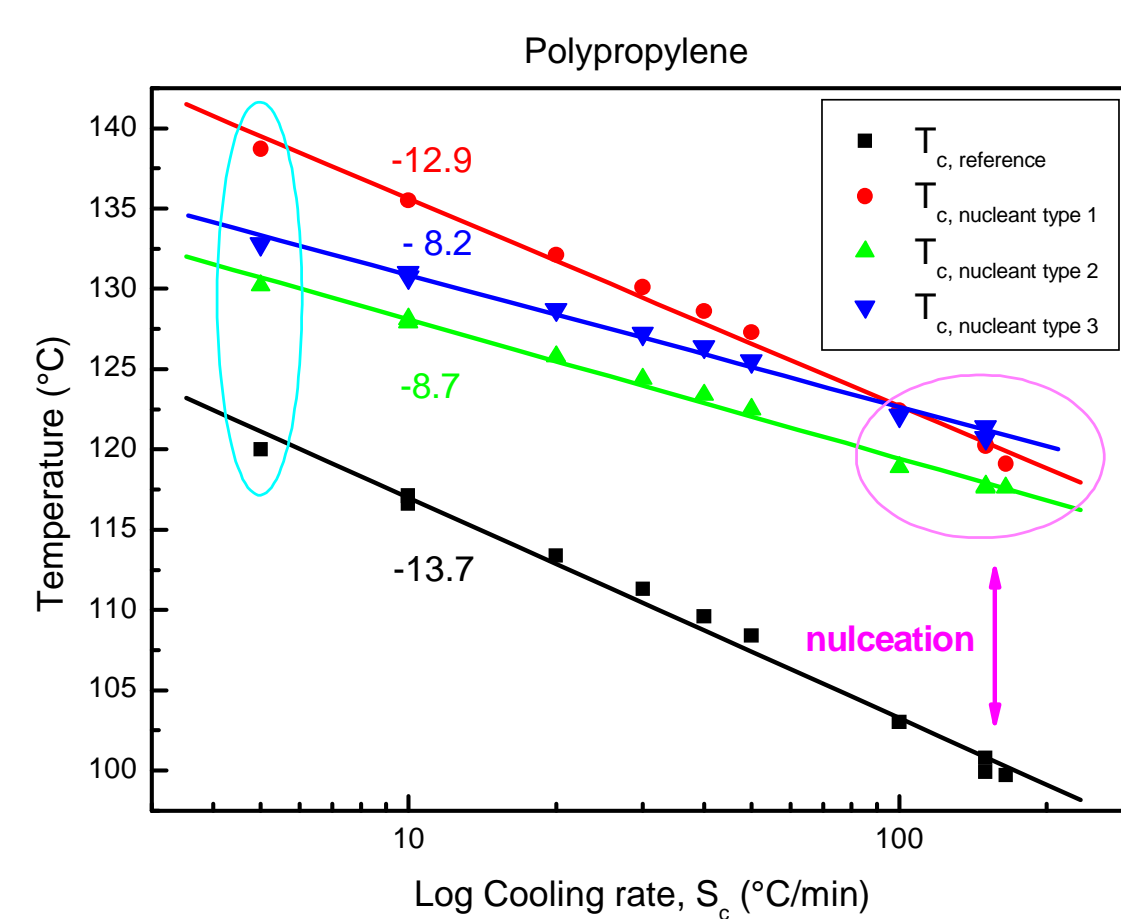
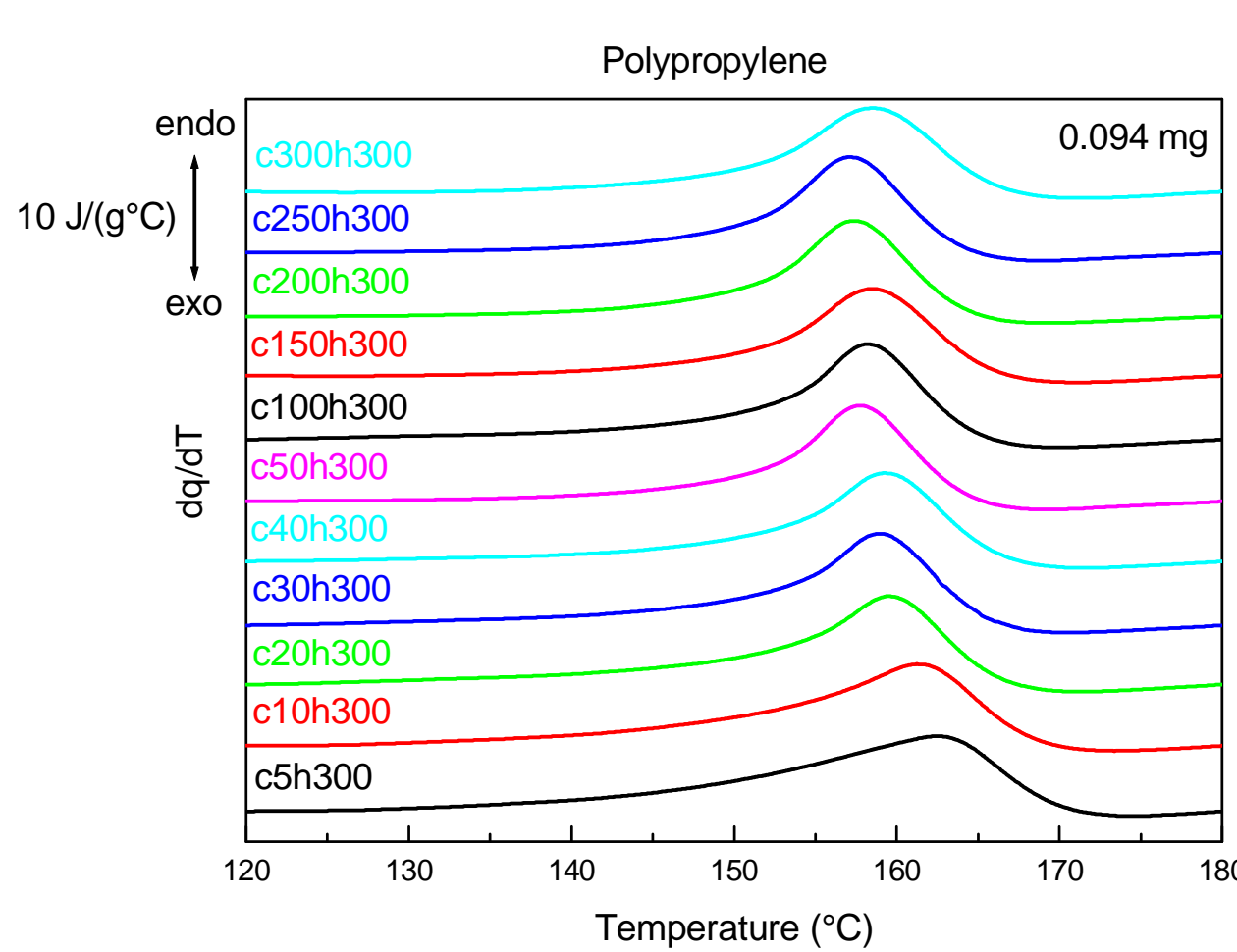
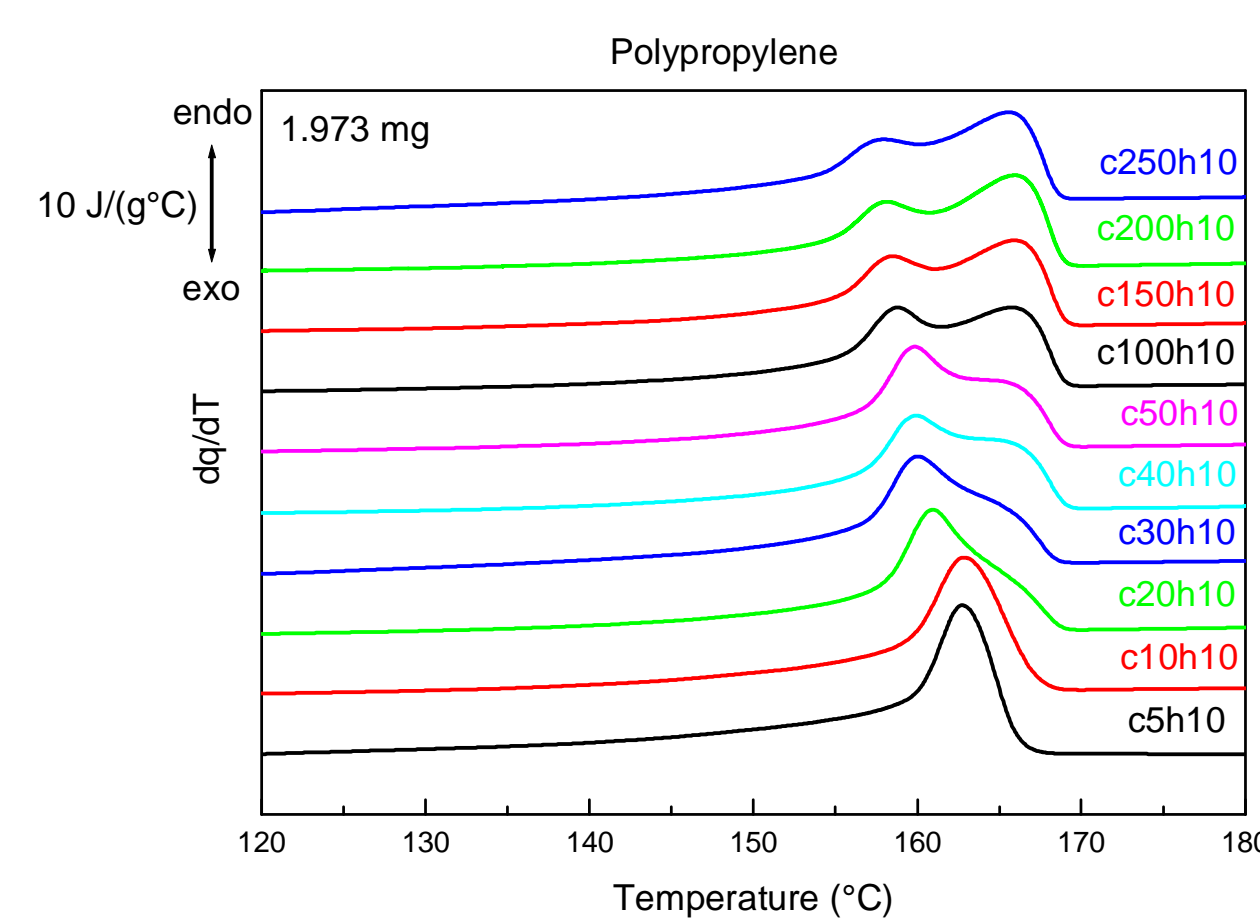


4. Influence cooling rate on crystallization

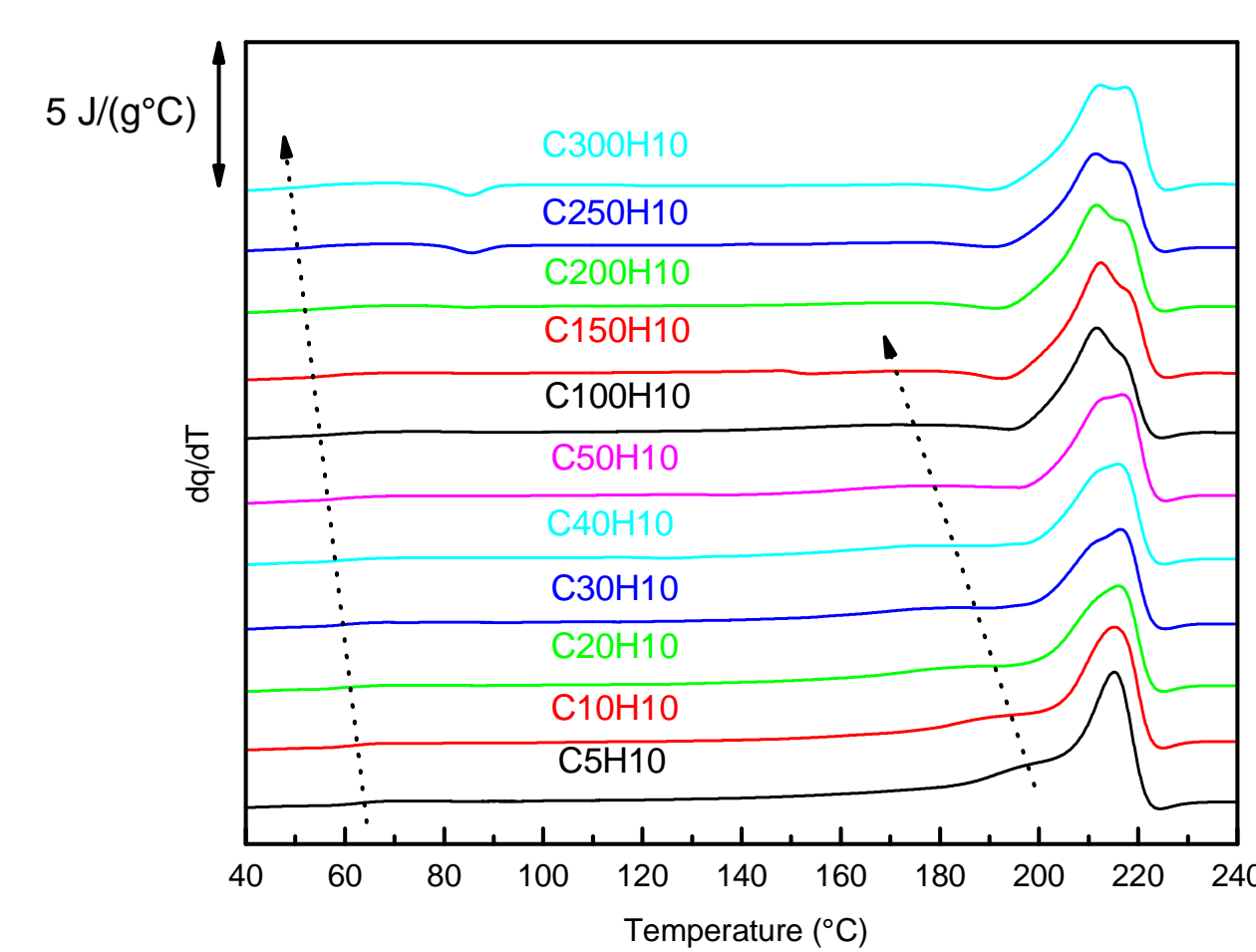


5. Application Polymers

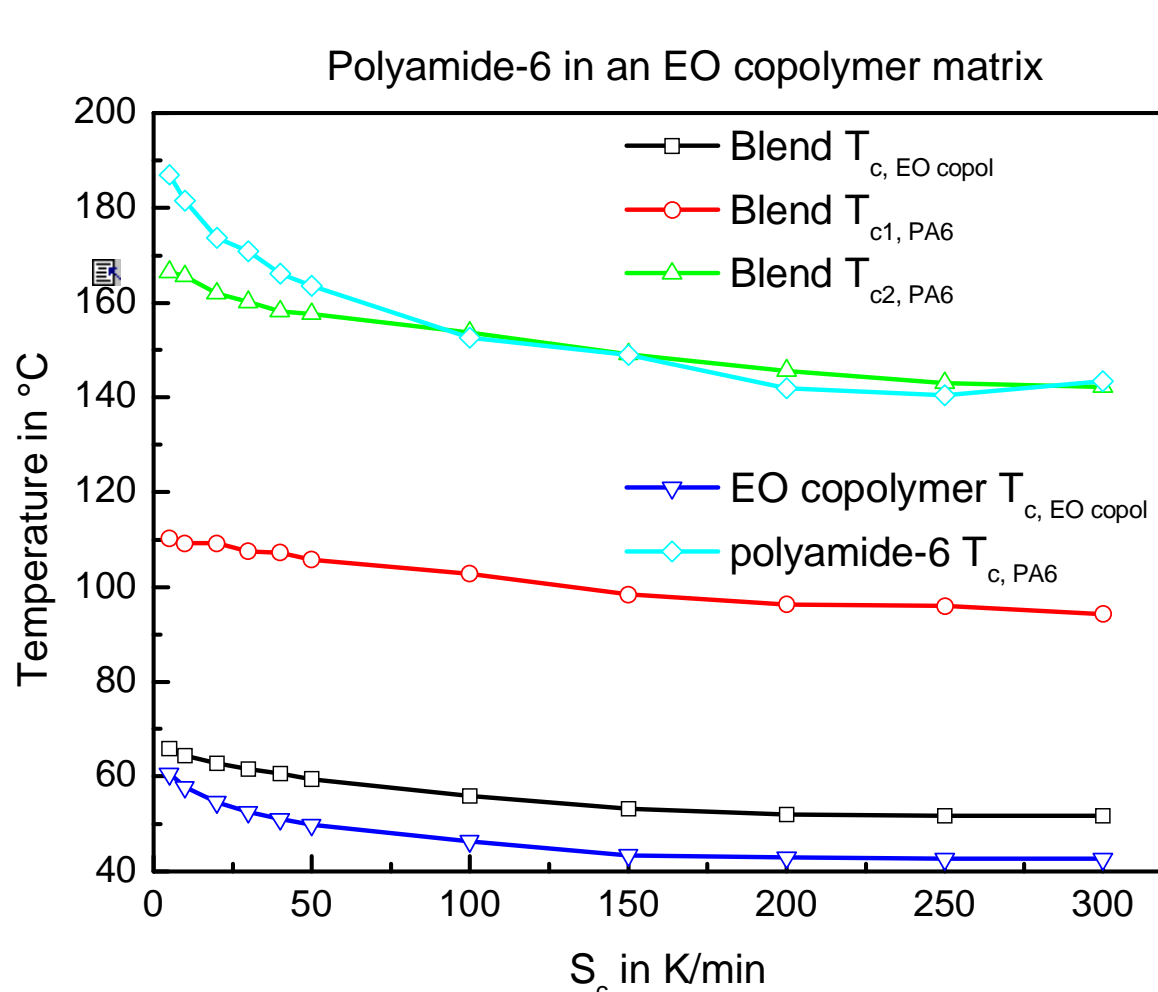
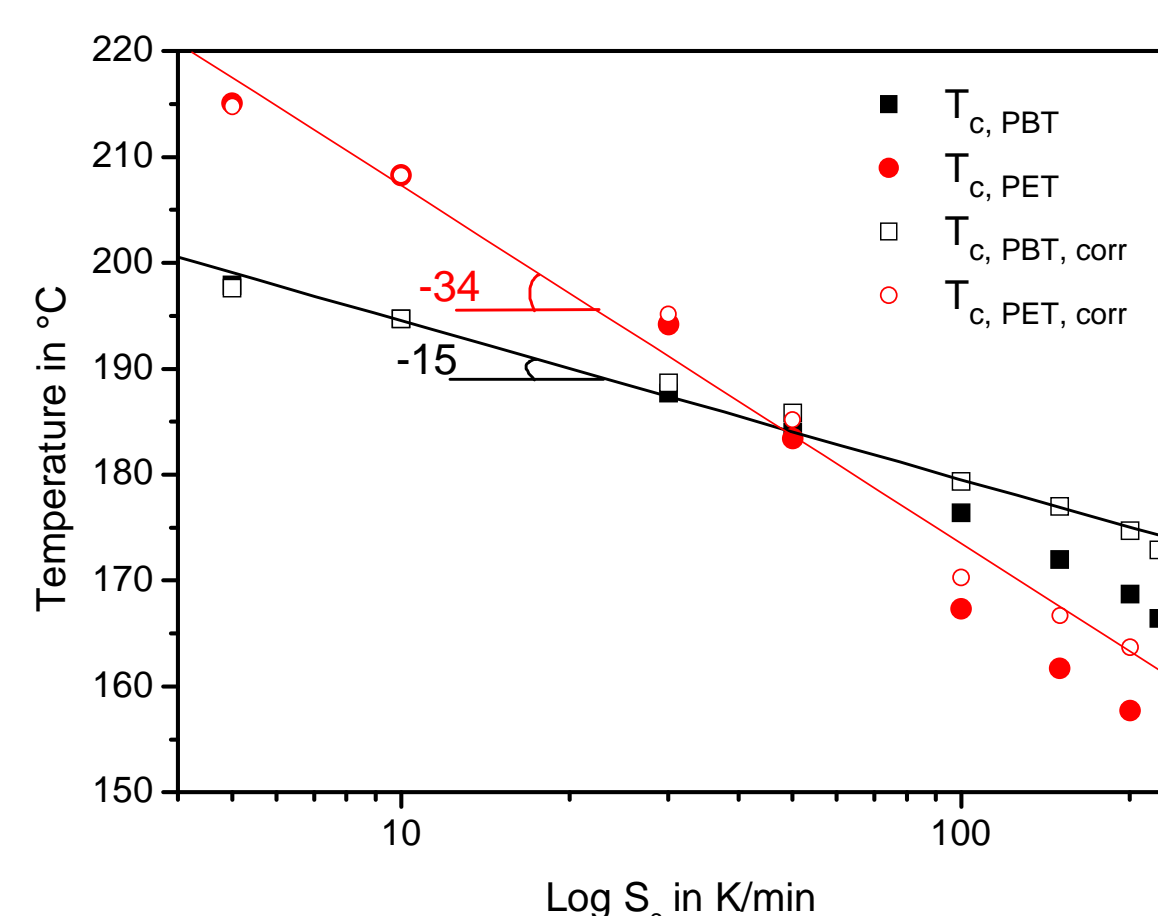
A. Polypropylene



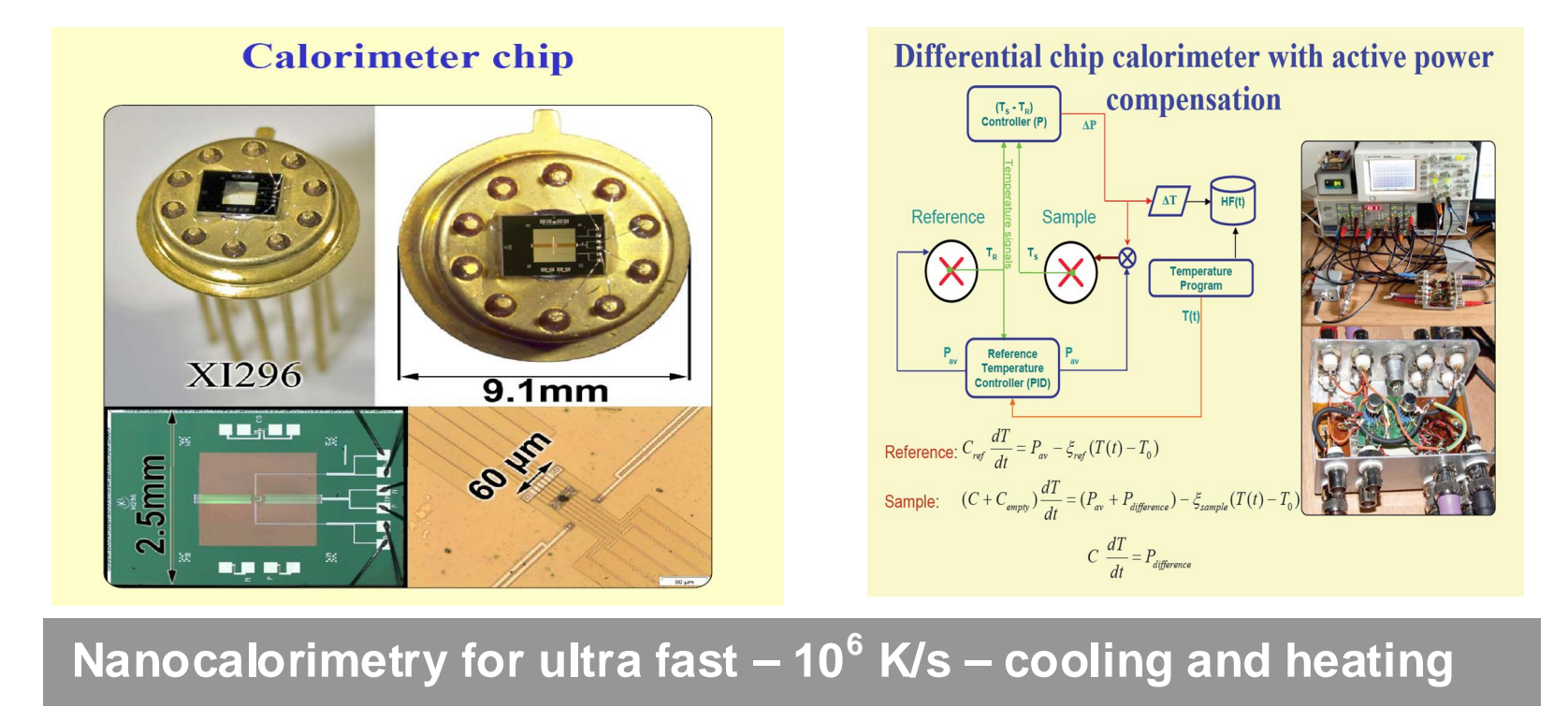
B. Polyamide 6



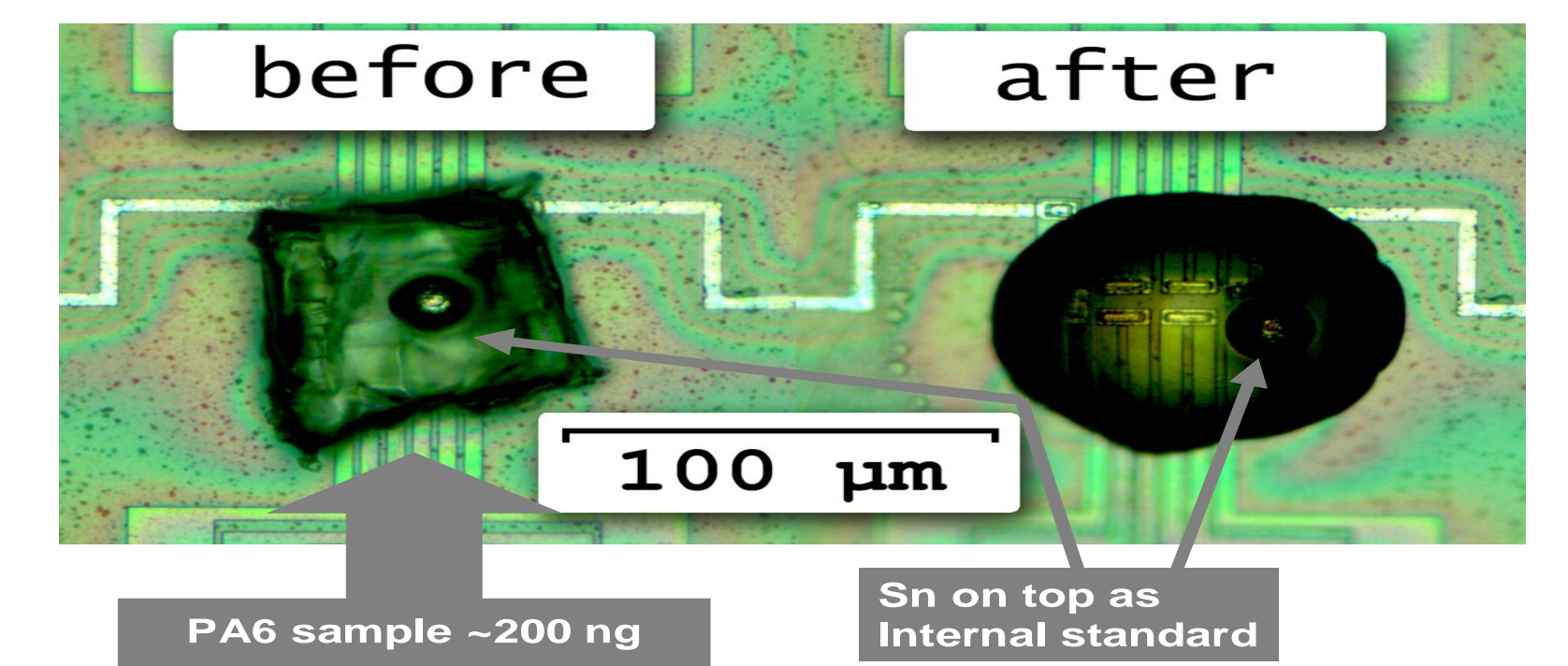
C. Polymer blends



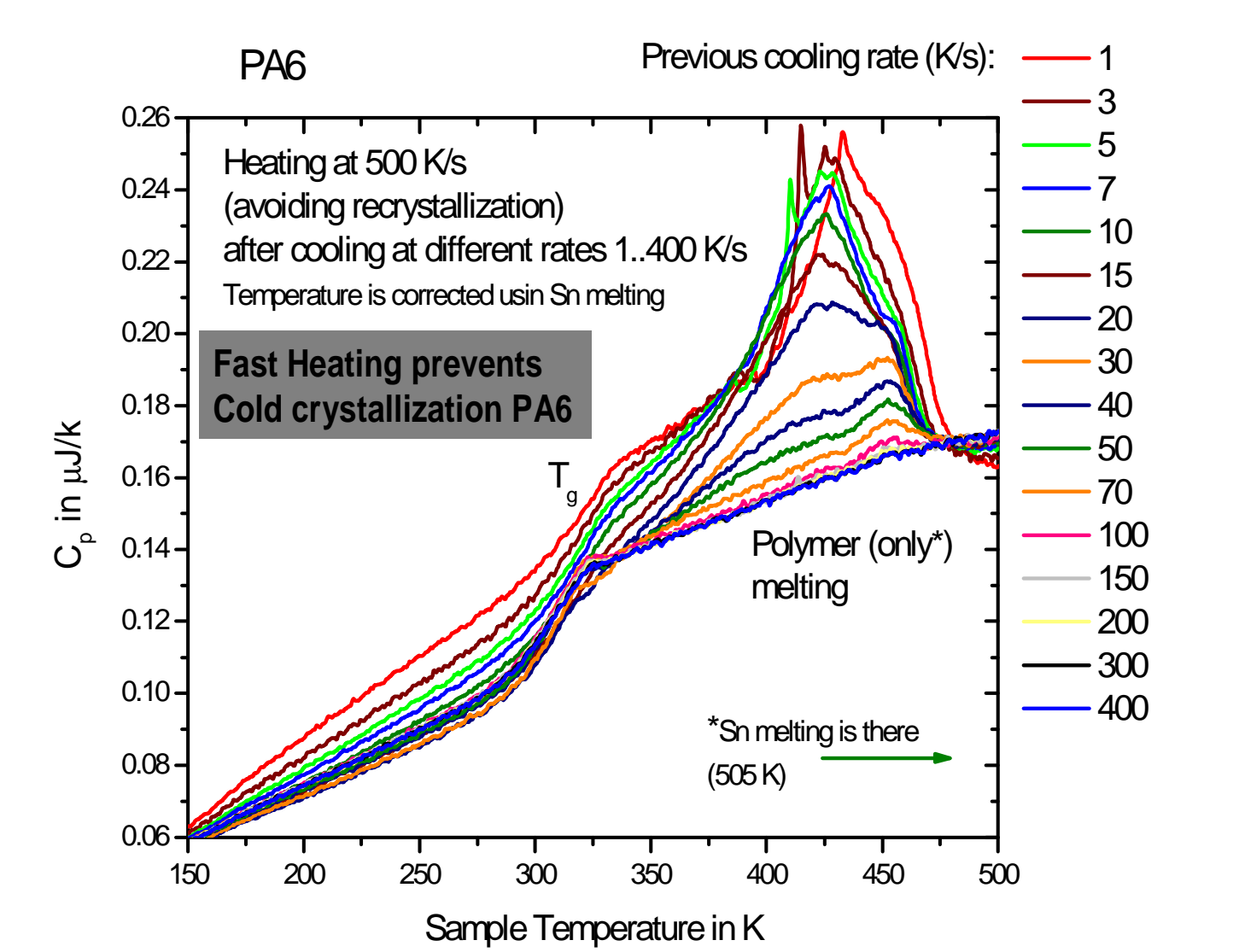
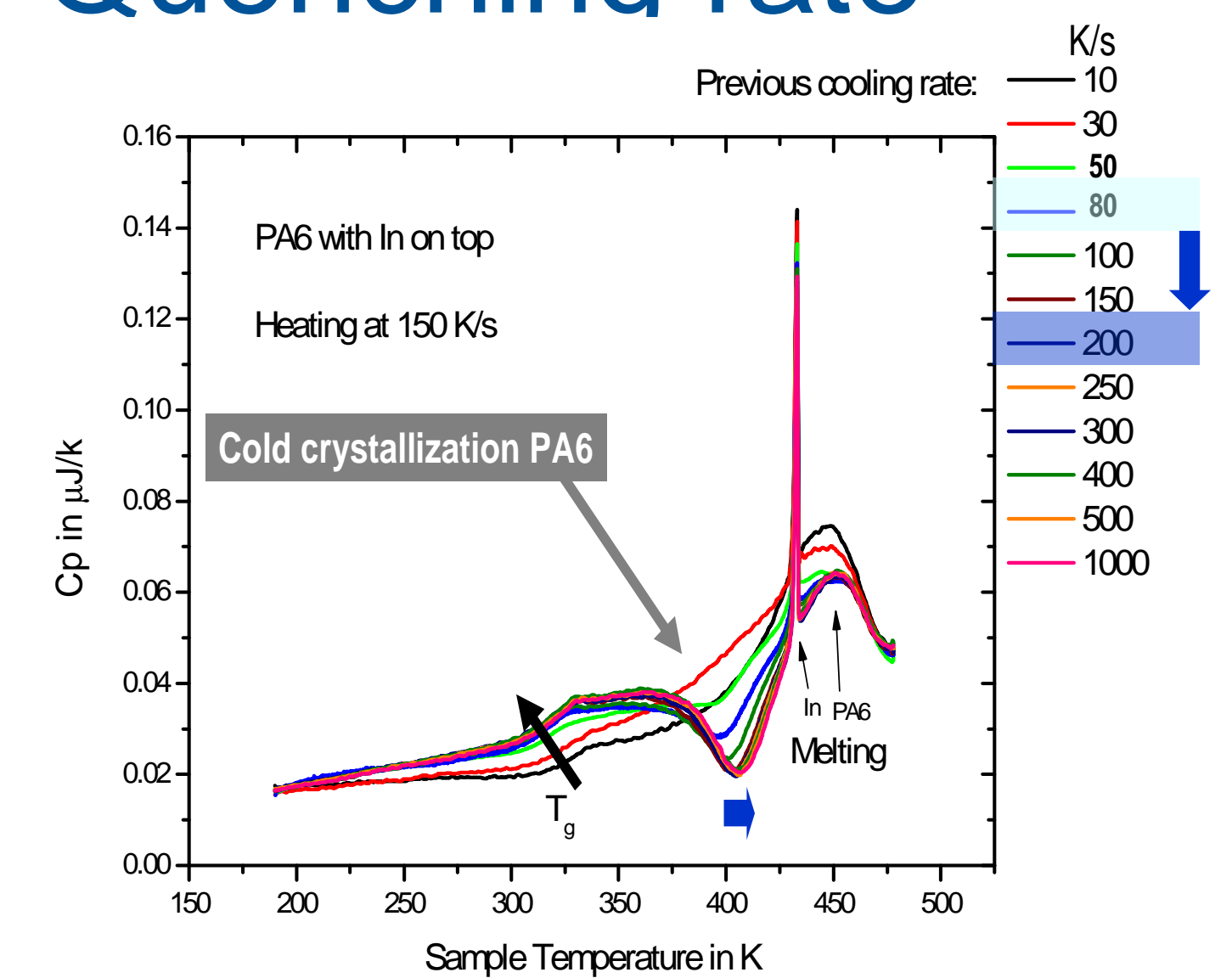
6. Ultra Fast Differential Scanning Chip Calorimetry



7. Sample Preparation



8. Quenching rate



PA6 becomes amorphous at 200 K/s !!!

9. References

- [1] High Performance DSC (HPer DSC; and its commercial equal: HyperDSC): T.F.J. Pijpers, V.B.F. Mathot, B. Goderis, R.L. Scherrenberg, E. van der Vegte, *Macromolecules* 32 (2002) 3601. G. Vanden Poel and V.B.F. Mathot, *Thermochimica Acta* 446 (2006) 41 and 461 (2007) 107; V.B.F. Mathot, G. Vanden Poel, T.F.J. Pijpers: Chapter 8, Benefits and Potentials of High Performance Differential Scanning Calorimetry (HPer DSC) in Volume 5: Recent Advances, Techniques and Applications; Handbook of Thermal Analysis and Calorimetry (Series Editor: Patrick Gallagher), 2008, p.269-297
- [2] Rapid Heat-Cool (RHC) DSC: R.L. Danley, P.A. Caulfield, S.R. Aubuchon, *American Laboratory*, January 2008, pp. 9-11
- [3] Chip calorimeter: M.Y. Efremov; J.T. Warren, E.A. Olson, M. Zhang, A.T. Kwan, L.H. Allen, *Macromolecules* 35(5) 2002 1481; S. Adamovsky, C. Schick, *Thermochimica Acta* 415 (2004) 1; A.A. Minakov, D.A. Mordvintsev and C. Schick, *Polymer* 45 (2004) 3755; A.A. Minakov, C. Schick, *Rev. Sci. Instrum.* 78, 073902 (2007); DOI:10.1063/1.2751411