

Introduction

Nanoporous polymer technologies present exciting new opportunities for fine tuning polymers for applications in ultrafiltration, selective membranes, or even selective catalysis. Polyethylene is a great candidate for such applications with its chemical robustness and favorable thermal properties. Block copolymers serve as an effective avenue for synthesizing such polymers given their affinity for micro phase separation.

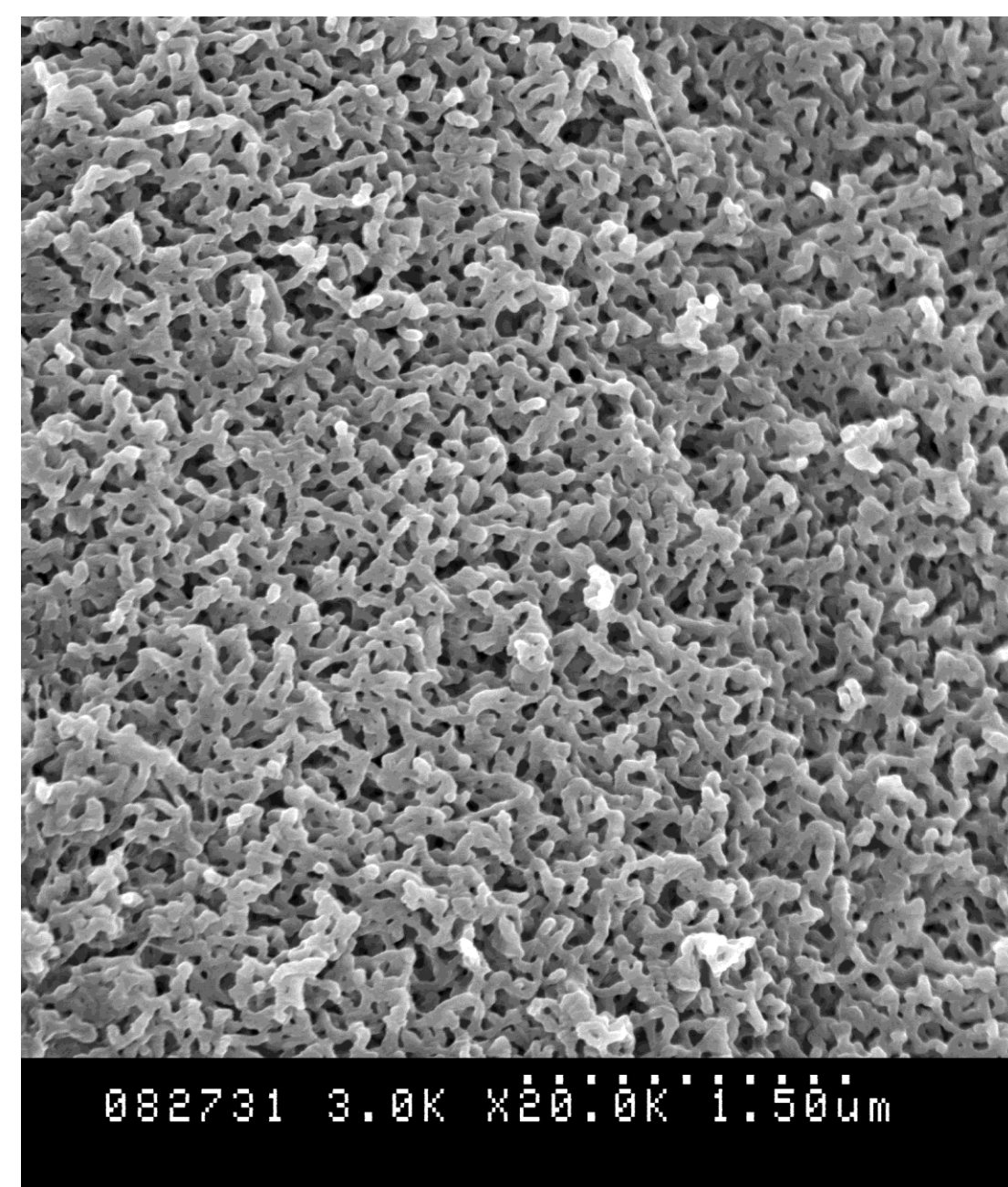
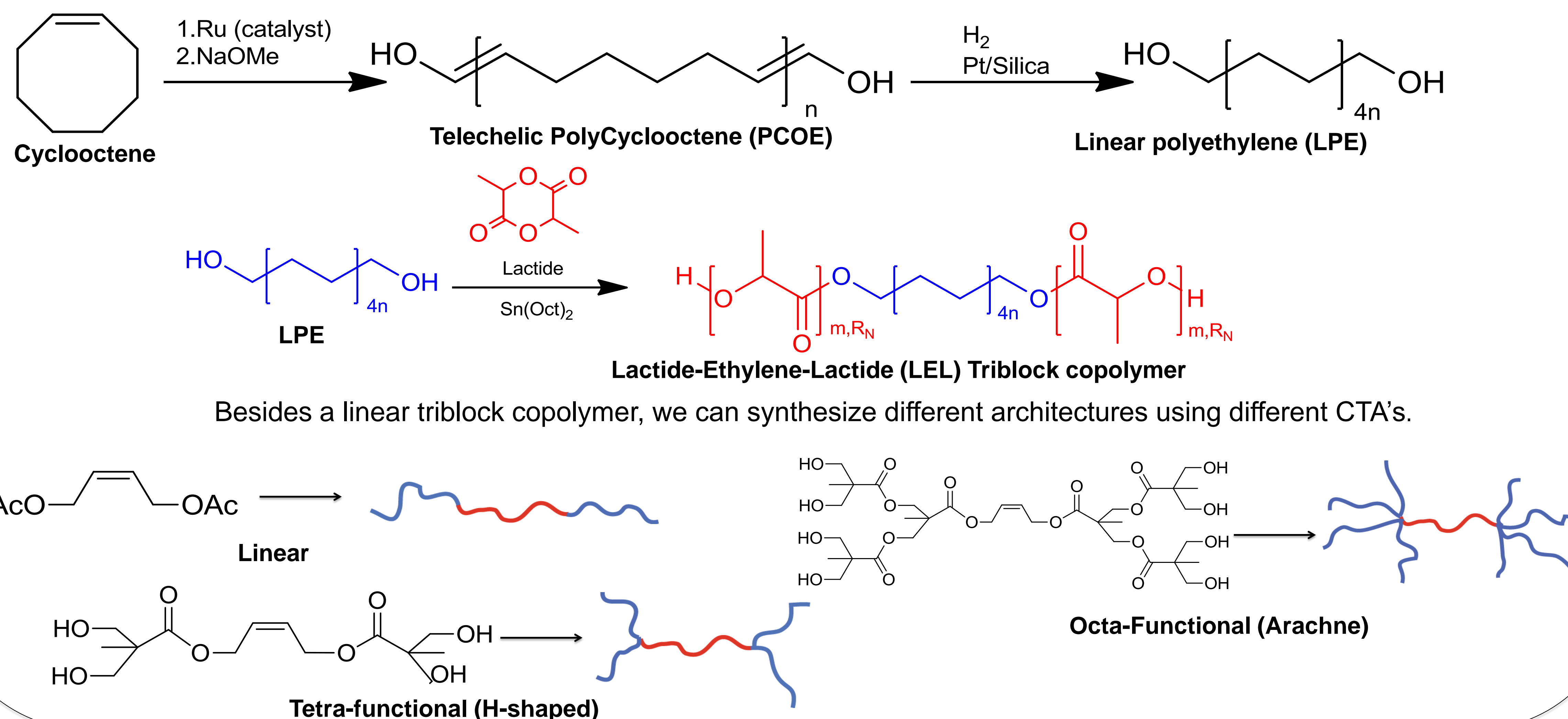


Figure 1: an SEM micrograph of a Poly(ethylene-lactide) tri-block copolymer after the removal the lactide blocks to reveal the porous ethylene membrane.

Synthesis of Copolymers with Linear and Multi-Functional Chain Transfer Agents



Removal (etching) of the Polylactide (PLA) blocks.

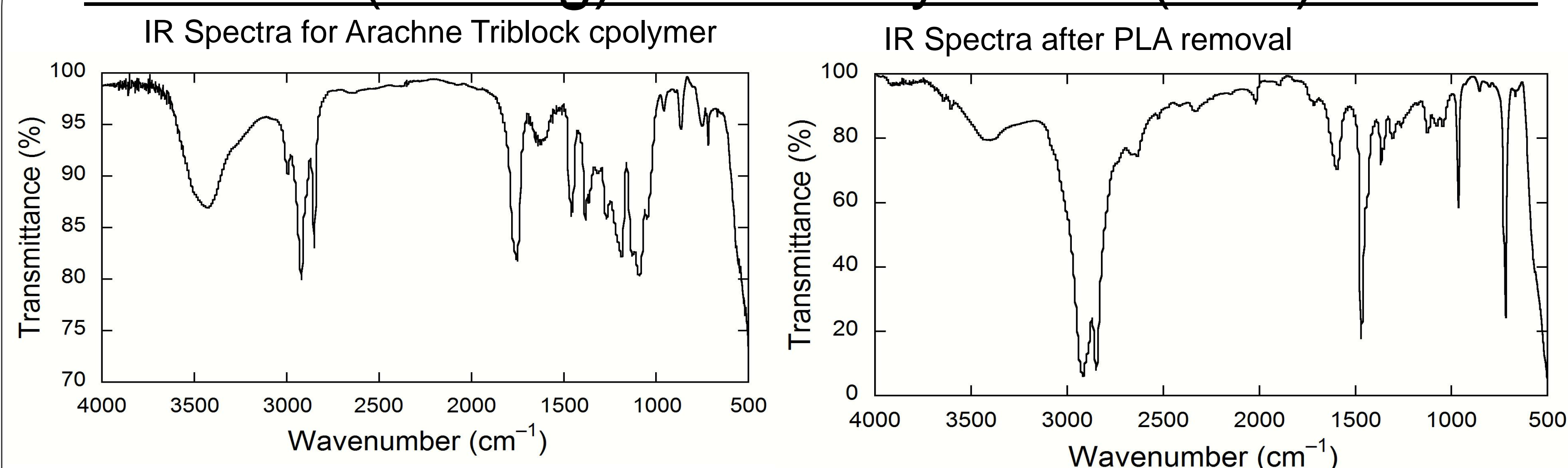


Figure 2: LEL triblock copolymer with a midblock molecular weight of 50 kg/mol with 65 wt% PLA

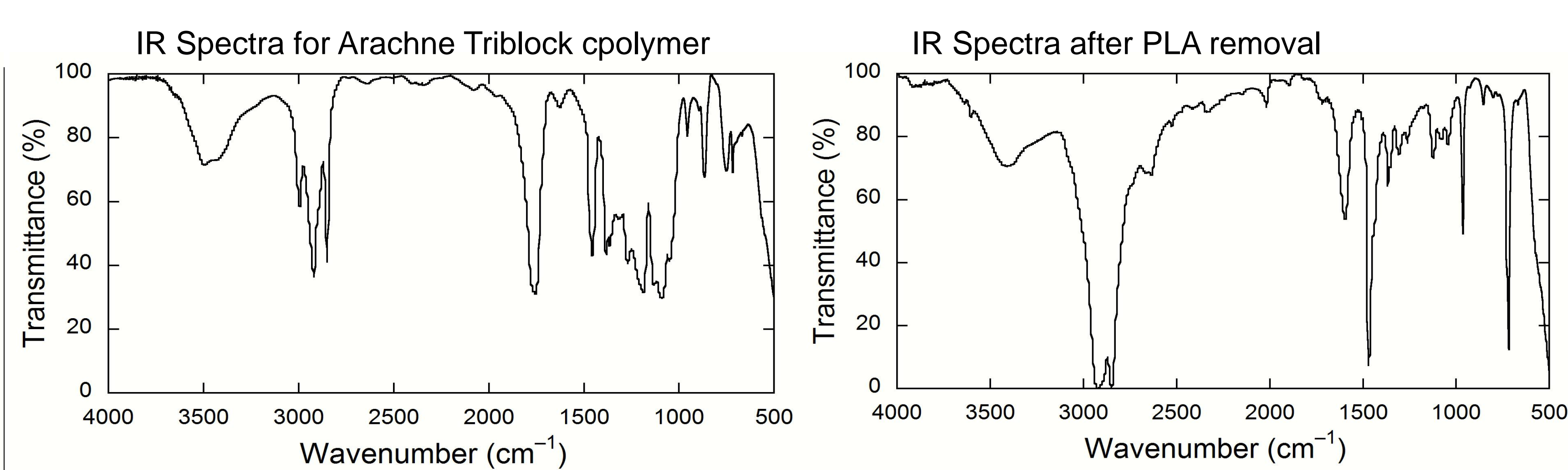


Figure 3: LEL triblock copolymer with a midblock molecular weight of 50 kg/mol with 75 wt% PLA

Crystallization Kinetics

By plotting the crystallization versus time we can fit this plot with the Avrami equation ($\phi_c = 1 - e^{-kt^n}$) to quantify the dimensionality of the crystal growth.

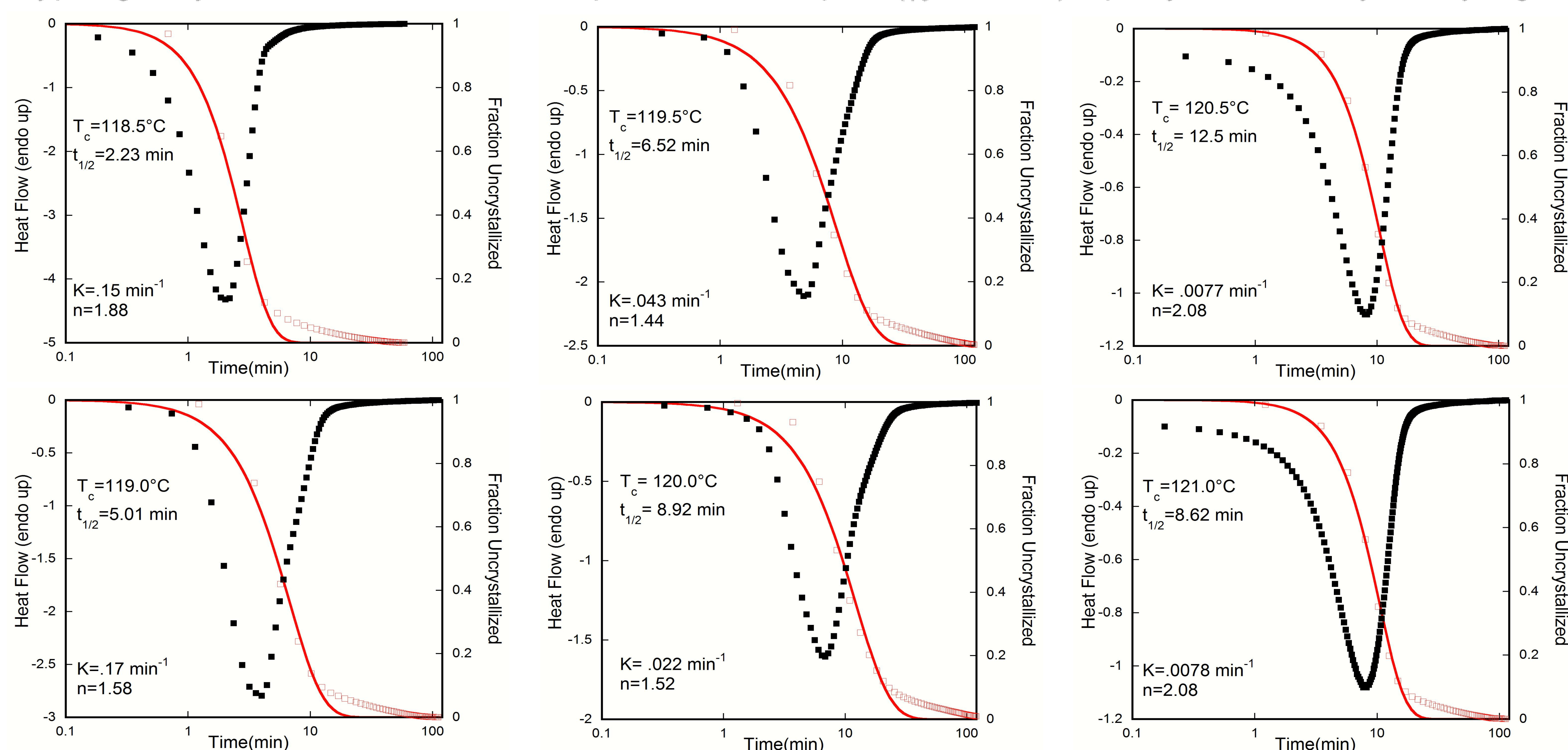


Figure 4: Both the heat flow and crystallization (fraction uncrystallized) are plotted on a log time scale at several temperatures.

$$\phi_c = 1 - e^{-kt^n}$$

T(°C)	t _{1/2} (min ⁻¹)	K (min ⁻¹)	n
118.5	2.23	.15	1.88
119.0	5.01	.17	1.58
119.5	6.52	.043	1.44
120.0	8.92	.022	1.52
120.5	12.5	.0077	2.08
121.0	8.62	.0078	2.08

Future Work

- Further characterization of homopolymers and copolymers with arachne, H-shaped, and linear structures.
- Functionalization of pores for applications as a separation membrane.
- Functionalization of pores for applications as heterogeneous catalyst specimen.
- Characterization of mechanical properties of homopolymers and copolymers

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Literature

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