

Flash posters session, Wednesday 9 September 12:35– 13:00 / Poster sessions P.08

(FP5) The kinetics of swelling in block copolymer thin films during “solvo- microwave” and solvo- thermal annealing: The effect of vapour pressure rate

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We have studied the kinetics of swelling in block copolymer thin films by monitoring the pressure and temperature *in situ* during “solvo-microwave” [1] and solvo-thermal annealing. The results on poly (styrene-*b*-lactic acid) PS-*b*-PLA thin film suggest that it's not the absolute value of the pressure (of THF here) and the temperature during annealing, but rather the rate at which the THF pressure increases is the key factor to obtain a good ordered pattern (see figure 1). At the next step, to show the kinetics effect, we have changed the heating rate in the oven. We will discuss that the rate of heating has a dramatic effect on the final morphology of the film. To our surprise, the fast heating rate (2-5 °C/min) in the oven at the early stage of annealing provides a good order with long average line length. Slower heating rate (< 1°C/min) lead to a poorly phase separated structure. The highly ordered patterns are a kinetically trapped structure rather than a thermodynamic equilibrium state

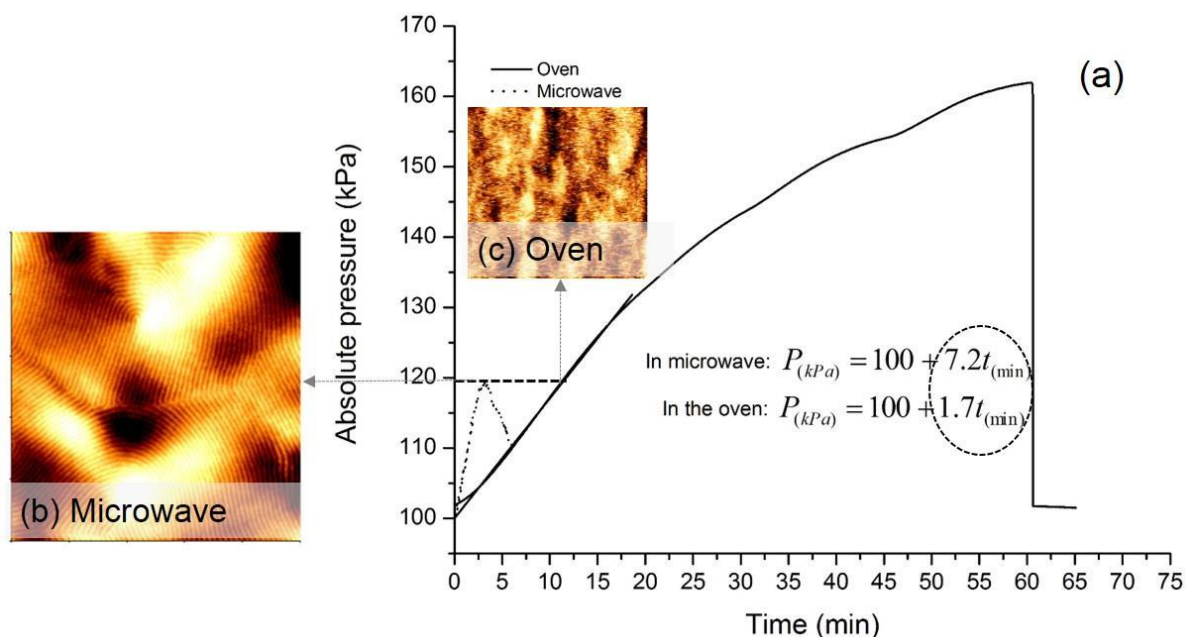


Figure 1. The absolute pressure measured during “solvo-microwave” annealing (dotted curve) and solvo-thermal annealing (solid line) in (a). AFM topography image of PS-*b*-PLA exposed to THF (b) in the microwave and (c) in the oven. Note that the temperature and pressure (120 kPa) is the same in the microwave and the oven (after about 12 minutes), but the phase separated patterns are totally different (compare (b) and (c)). The major difference is due to heating rate and vapour pressure ramp.

- [1] Mokarian-Tabari, P.; Cummins, C.; Rasappa, S.; Simao, C.; Sotomayor Torres, C. M.; Holmes, J. D.; Morris, M. A., Study of the Kinetics and Mechanism of Rapid Self-Assembly in Block Copolymer Thin Films during Solvo-MicrowaveAnnealing. *Langmuir : the ACS journal of surfaces and colloids* 2014, 30 (35), 10728-39