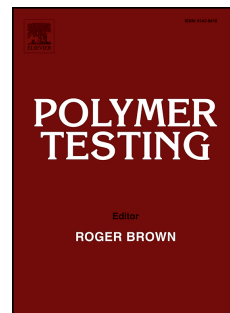


Accepted Manuscript

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PII: S0142-9418(14)00120-2

DOI: [10.1016/j.polymertesting.2014.05.012](https://doi.org/10.1016/j.polymertesting.2014.05.012)

Reference: POTE 4245

To appear in: *Polymer Testing*

Received Date: 19 April 2014

Accepted Date: 26 May 2014

Please cite this article as: Y. Xu, Y. Wang, T. Xu, J. Zhang, C. Liu, C. Shen, Crystallization kinetics and morphology of partially melted poly(lactic acid), *Polymer Testing* (2014), doi: 10.1016/j.polymertesting.2014.05.012.

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Crystallization kinetics and morphology of partially melted poly(lactic acid)

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ABSTRACT

The nonisothermal and isothermal crystallization behavior of pre-crystallized poly(lactic acid) (PLA) after partial or complete melting was investigated. After partial melting, the maximum crystallization peak shifts to higher temperature by 30 °C during subsequent cooling, indicating that self-nucleation greatly enhances the overall crystallization rate of PLA. Partial melting leads to predetermined athermal nucleation at higher temperature, while complete melting results in sporadic nucleation at lower temperature. Spherulitic and irregular morphologies are formed for the sample partially melted at 178 °C and 176 °C (or 175 °C), respectively. The isothermal crystallization data were analyzed by the Avrami model. The values of the Avrami exponent for partially melted PLA are comparable to that of completely melted material, indicating that self-nucleation does not change the crystallization mechanism of PLA. Irregular spherulites are formed for PLA partially melted at 176 °C during subsequent isothermal crystallization, and the nucleation density decreases with increasing crystallization temperature.

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