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PII: S0040-6031(17)30084-9
DOI: http://dx.doi.org/doi:10.1016/j.tca.2017.03.026
Reference: TCA 77717

To appear in: *Thermochimica Acta*

Received date: 21-11-2016
Revised date: 28-3-2017
Accepted date: 29-3-2017

Please cite this article as: Yuzhu Chen, Hui Xiao, Jiulong Xie, Jinqiu Qi, Jing Li, Huijuan Shao, Qualitative analysis of pre-curing process of UF resin, Thermochimica Actahttp://dx.doi.org/10.1016/j.tca.2017.03.026

Qualitative analysis of pre-curing process of UF resin

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Highlights

- The pre-curing mechanism of UF resin was proposed.
- The pre-curing process of UF resin was unsynchronized.
- The occurrence of pre-curing behavior and its degree could be accurately judged.

Abstract: The rheological behavior, molecular weight distribution (MWD), reactivity, and chemical structures of UF resin during the pre-curing process were elucidated by rheometry, gel permeation chromatograph (GPC), differential scanning calorimetry (DSC), and ^{13}C-NMR, respectively. The unsynchronized increasing processes between viscosity and rigidity during the pre-curing process were closely related to the changes of activation energy, MWD, and chemical structures. The results indicated that, due to the pre-curing behavior showed significant influence on the activation energy, both the occurrence of pre-curing behavior and its degree could be accurately judged, and the change trend of MWD and the chemical structures of the pre-curing resin could be also predicted by the non-isothermal DSC method. Once the value of E_a was higher than that of E_0, the degree of cross-linking was increased and the network structure was formed indicating that the pre-curing behavior of UF resin had taken place.

Keywords: pre-curing process; rheological behavior; thermal property; molecular weight distribution; chemical structure

1. Introduction

UF resin is a dominant thermosetting wood adhesive in the manufacturing of wood composites such as particleboard and medium density fiberboard (MDF). Usually, MDF is the main material for interior furniture and interior decoration. Blow-line blending is a preferred method in manufacturing MDF because the resin distributed much more uniformly compared to that using mechanical blending method. However, in the drying pipeline, the resin is exposed to high temperature, humidity, and curing agents, and all that will induce the occurrence of cross-linking reaction and pre-curing behavior resulting in low efficiency of the resin.