Accepted Manuscript


Title: Cure kinetics and rheology modelling of boehmite (AlOOH) nanoparticle modified epoxy resin system

Authors: Dilmurat Abliz, Tobias Jürgens, Tatjana Artys, Gerhard Ziegmann

PII: S0040-6031(18)30443-X
DOI: https://doi.org/10.1016/j.tca.2018.06.017
Reference: TCA 78030

To appear in: *Thermochimica Acta*

Received date: 15-12-2017
Revised date: 7-5-2018
Accepted date: 26-6-2018

# Cure kinetics and rheology modelling of boehmite (AlOOH) nanoparticle modified epoxy resin system

Dilmurat Abliz, Tobias Jürgens, Tatjana Artys, Gerhard Ziegmann
Institute of Polymer Materials and Plastics Engineering, Clausthal University of Technology, Agricolastr.6, 38678 Clausthal-Zellerfeld, Germany
Clausthal Center for Materials Technology, Clausthal University of Technology, Leibnizstraße 9, 38678 Clausthal-Zellerfeld, Germany

Correspondence to: Dilmurat Abliz (E-mail: dilmurat.abliz@tu-clausthal.de)

Highlights

- Influence of boehmite nanoparticles on the cure and rheological behavior of epoxy;
- Modelling the cure kinetics and rheology of boehmite-epoxy matrix;
- Model parameter analysis and correlation to nanoparticle concentration;

## ABSTRACT

Nanoparticles can effectively increase the resin matrix properties, which is especially attractive for fabrication of high-performance fiber composites by liquid composite molding (LCM) processes. However, the cure kinetics and rheological behavior of the matrix, which are the most critical aspects in LCM processes, could be affected by the introduction of nanoparticles, depending on the surface functionalization and concentration. In this paper, the cure kinetics and rheology of boehmite nanoparticle modified epoxy matrix is characterized and modelled. The influence of boehmite nanoparticles on cure and rheological behavior is analyzed. By optimization of the regression method combined with model parameter analysis, a good correlation between the model parameters and NP concentration is determined. Finally, a generalized model is put forward to describe and predict the cure kinetics and rheology depending on time, temperature, and concentration of nanoparticles.

**Key words:** Nanocomposite; Cure kinetics; Rheology

## 1 INTRODUCTION

Nanoparticles (NPs) can effectively improve the critical matrix-dominated mechanical (e.g. interlaminar shear, fracture toughness, impact and damage tolerance) and thermal properties of fiber reinforced polymer (FRP) structures [1-4]. Therefore, modification of FRPs with NPs is especially attractive for liquid composite molding (LCM) processes, which allows for low-cost production of high-performance FRPs [5, 6]. The effectiveness of NPs depends on the chemical (composition, surface modification) and physical (size, morphology, concentration) characteristics. However, depending on these characteristics, NPs affect the critical impregnation processing