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Research Article

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Isothermal Thermogravimetric Analysis of Recycled Carbon Fiber Composites

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Abstract

Isothermal Thermogravimetric Analysis (TGA) is a technique in which the mass of a substance is monitored as a function of time as the sample specimen is subjected to a controlled temperature program in a controlled atmosphere. In this research, isothermal TGA was carried out to determine the thermal stability of the recycled epoxy-based and vinyl ester-based carbon fiber composite (CFC). The specimens were heated at constant temperature under nitrogen and air. We evaluate the influence of different temperature on the degradation of recycled CFCs. Results indicate that different temperature has significant influence on the degradation of the recycled CFC under nitrogen.

Introduction

A TGA can be used for materials characterization through analysis of characteristic decomposition patterns [1]. It is an especially useful technique for the study of polymeric materials, including thermoplastics, thermosets, elastomers, composites, plastic films, fibers [2-3] in this research we analyzed recycled epoxy-based CFC and vinyl ester-based CFCs isothermal stability. Each specimen was heated for 25min [4-5]. For each specimen, it takes around 7 min that we reach the targeted temperature [6-8]. Isothermal TGA results of epoxy-based CFC shows that by increasing the isothermal temperature, degradation increased. After 25 min. At 340 °C the epoxy-based CFC material has the remaining of 88% and at 380 °C it is around 77 %.

After 25 min., vinyl ester-based CFC material has the remaining of 89 % at 340 °C and 73 % at 380 °C. (figure 1 & 2). Results indicates that epoxy-based CFC and vinyl ester-based CFC have similar trend of degradation under nitrogen [9-10].

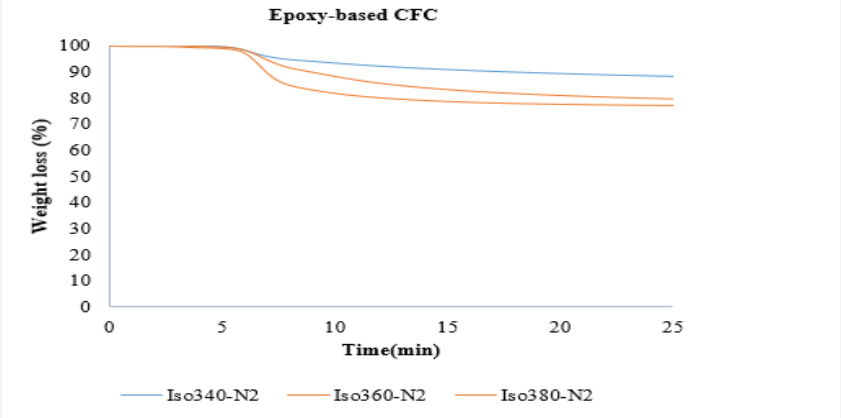

Figure 1: Isothermal TGA curve of epoxy-based CFC recorded in nitrogen (considering the influence of temperature).

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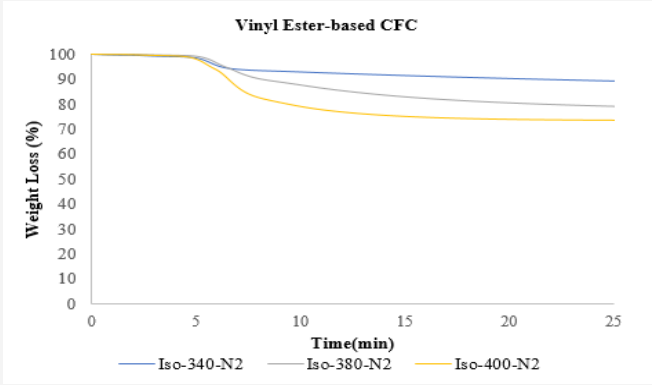

Figure 2: Isothermal TGA curve of vinyl ester-based CFC recorded in nitrogen (considering the influence of temperature).

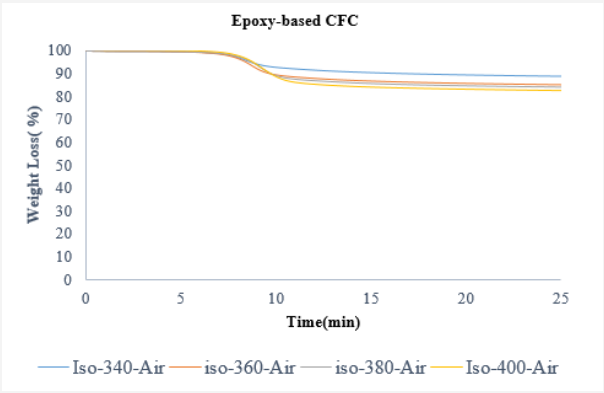

Figure 3: Isothermal TGA curve of epoxy-based CFC recorded in air (considering the influence of temperature).

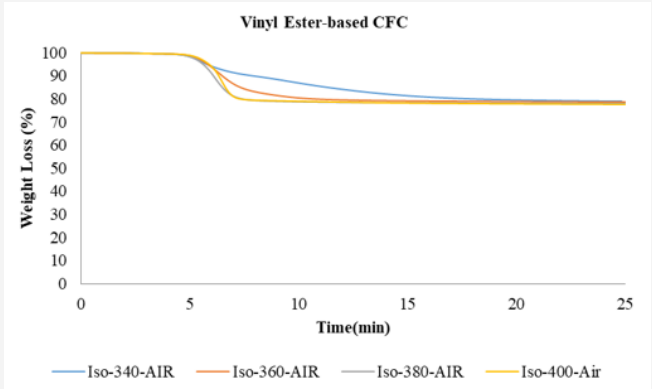

Figure 4: Isothermal TGA curve of vinyl ester-based CFC recorded in air (considering the influence of temperature).

Isothermal TGA results of epoxy-based CFC shows similar trend (Figure 3 & 4). After 25 Min. the remaining of epoxy-based CFC is 88%, 85%, 83% and 82% at 340 °C, 360 °C, 380 °C and 400 °C respectively. Isothermal TGA results of vinyl ester-based CFC indicates that by increasing the temperature degradation happened faster. After 25min, the vinyl ester-based CFC has the remaining of 77% for almost every temperature.

The isothermal TGA results of recycled CFCs is a key factor for manufacturing the second-generation composites from recycled materials. Isothermal TGA results of epoxy-based CFC and vinyl ester-based CFC indicate that there is a safe zone for processing these materials. For all the samples isothermal results is almost consistent after 7min. and no degradation happened after that.

Acknowledgement

None.

Conflict of Interest

No Conflict of Interest.

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