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Mechanisms of thermal decomposition of natural fibre composites

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Abstract

This paper presents research pertaining to the thermal decomposition of natural fibre composites (NFC). The behaviour and damage profile of NFCs have been determined, and comprehensive mechanisms of thermal decomposition interpreted at both macroscopic and microscopic levels. The results show that the process of thermal decomposition of NFCs underwent complex processes from the initial light discolouration to blackening and in some cases blistering, and from the decomposition of polyester to fibres to delamination of lamina with the dictated influence of natural fibre and interface structure. Ignition was closely related to the Vf of NFCs. The damage profile of NFCs included a combust region, a char region, a degradation region and a region of virgin material. This paper concludes that the thermal decomposition of NFC is different from that of GFRP and hence its thermomechanical modelling will require the development of specific terms to account for the inclusion of natural fibres.

Keywords: A-Polymer-matrix composites; B-Thermal properties; D-Optical microscopy; E-Heat treatment; Thermal decomposition mechanisms

1 Introduction

Natural fibre composites (NFC) have been identified as a potential low impact alternative to glass fibre reinforced polymers (GRP) for use in the construction industry. GRPs have, up until recently, been more economically viable than NFCs. However, with the economic viability of construction materials set to become increasingly influenced by their embodied impact, natural fibres that are less harmful to humans, machinery and the environment are a realistic alternative to the energy intensive production of glass fibre. If with research and