EFFECT OF STRAIN RATE ON INDENTATION BEHAVIOUR OF KENAF-BASED FIBRE METAL LAMINATES

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INTRODUCTION

Kenaf natural fibre has become the subject of interest for a wide range of engineering sectors due to its biodegradable and robust mechanical properties [1, 2]. Akil et. al. [3] presented a review on kenaf fibre reinforced composites and mentioned that the application of kenaf fibre-reinforced composite as an alternative composite material is highly plausible with both lightweight and low cost as its main advantages. This situation has lead researchers to investigate the potential offered by kenaf fibre reinforced composites [4-6]. However, research on kenaf-based fibre metal laminates (FMLs) is still not clear and thus demands extensive research investigation. In this study, the effect of strain rate on the indentation behaviour of the FMLs subjected to static indentation loading was investigated.

The fibre metal laminates were made of chopped strand mat kenaf fibre with epoxy resin composite and 0.6 mm thickness of 1100-O aluminium alloy sheet by using vacuum infusion process (VIP) and hydraulic pressing technique. Several samples of 2/1 lay-up and 3/2 lay-up of FMLs were prepared for indentation tests. The experiments were conducted by using a universal testing machine with strain rate of 1 mm/min, 10 mm/min and 100 mm/min.

MAIN RESULTS

The indentation resistance, energy absorption and corresponding indentation failure mechanisms are investigated in this study. In this extended abstract, contact force versus indentation depth curves of 2/1 FMLs was shown in Figure 1. For all the strain rate tested on the specimens, the contact force is increased linearly with increasing the indentation depth to the yield point, but failed at different maximum contact force. The maximum contact force increased when the strain rate increased which are 3.40 kN for 1 mm/min, 3.50 kN for 10 mm/min and 3.68 kN for 100 mm/min.

In quasi-static indentation, when strain rate was increased, more contact force is required to deform the specimen. The contact force was used to make a dent on the indented point, followed by a circular crack and then to push the upper most aluminium and kenaf plies through the rear surface opening. The specimen was failed when a hole was produced after achieved the maximum contact force. The failure mechanisms of the indented FMLs were characterized by examining the front and rear surfaces. However, it was found that, the strain rate did not affect the static indentation failure mechanisms of 2/1 FMLs. Hence, in this extended abstract, only indented 2/1 FMLs with strain rate of 10 mm/min was shown (Figure 2).

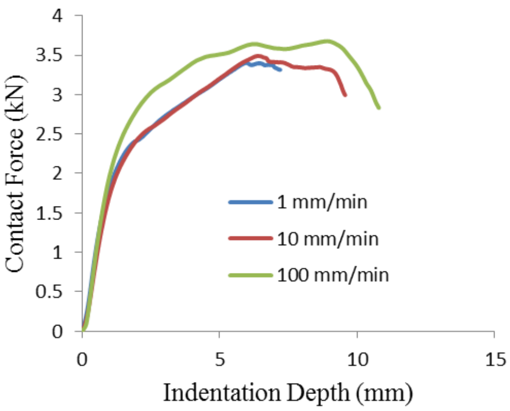

Figure 1. Contact force versus indentation depth curves of 2/1 FMLs.

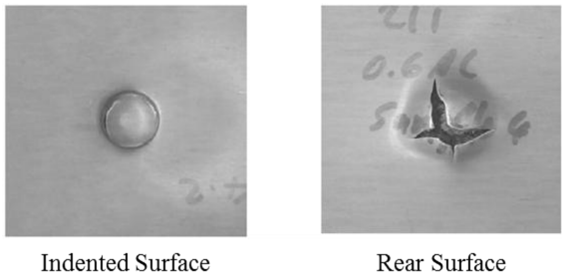

Figure 2. Photographs of the indented 2/1 FMLs with strain rate of 10 mm/min.

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