A Study on the Fracture Characteristics of Tapered Double Cantilever Beam Bonded with Adhesive Using Composite Materials for Lightweight

J. U. Cho[1*], J. H. Lee[2], C. D. Cho[3] and S. S. Cheon[1]

[1]Division of Mechanical & Automotive Engineering, Kongju National University, Cheonan-si, Republic of Korea
[2]Department of Mechanical Engineering, Graduate School, Kongju National University, Cheonan-si, Republic of Korea
[3]Department of Mechanical Engineering, Inha University, Incheon, Republic of Korea

[*]Corresponding author: jucho@kongju.ac.kr

1. Introduction

In order to increase the fuel efficiency of the transport vehicles because of environmental pollution problems nowadays, the light weight in various machinery, aircraft and automobile industries is an essential factor. This light weight is being done in many areas and the tightening method is also changing with the material changes to be applied. In this study, the method of fastening the light weight material with adhesive was examined. The inhomogeneous composite materials composed of CFRP, aluminum and aluminum foam glued together with adhesive were manufactured as the tapered cantilever beam. The static fracture experiments were carried out and the fracture characteristics on the adhesive interfaces of each double cantilever beams were investigated [1].

2. Study method

Fig. 1 shows the dimensions and configuration of the double cantilever beams used in this study. The dimensions and configuration of each double cantilever beam are all the same. A total three inhomogeneous materials of CFRP-aluminium foam, and aluminum-aluminium foam were manufactured and the static fracture tests were carried out [2]. Fig. 2 describes the experimental conditions applied to double cantilever beams. The upper pin hole is given a forced displacement of 1 mm/min and the lower pin hole is fixed to carry out a static fracture test.

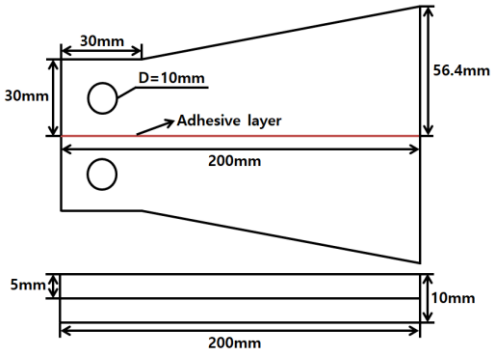

Fig. 1 Dimensions and configuration of tapered double cantilever beams

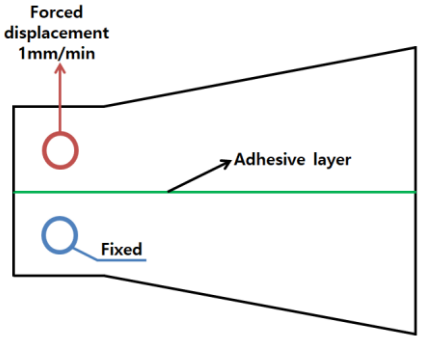

Fig. 2 Experimental conditions of tapered double cantilever beams

3. Study result

Fig. 3 shows the graph on the reaction forces to forced displacements at static experiments on double cantilever beams with CFRP-aluminium which can be seen as those points of times. The maximum reaction force appeared when the forced displacement was approximately 6 mm in progress, and it can be seen that the maximum reaction force of approximately 1100N happens.

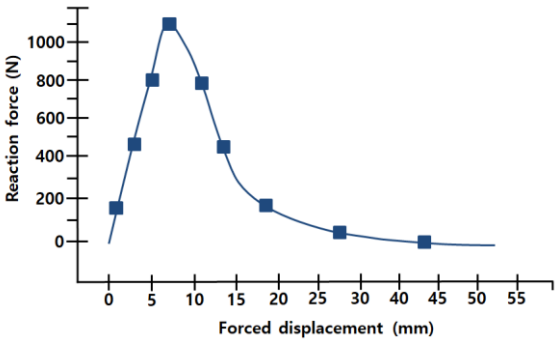

Fig. 3 Reaction forces to forced displacements at tapered double cantilever beams with CFRP-aluminum)

4. Conclusions

In this study, the specimens of tapered double cantilever beams were bonded with adhesive by combining with lightweight materials of CFRP, aluminum, and aluminum foam. And static fracture experiments were carried out. The conclusions

obtained from this study are as follows;

1. The fracture characteristics on the adhesive interface of tapered double cantilever beams by each material could be examined.
2. Based on the result data obtained, when the maximum and maximum reaction forces at each specimen happened, those points of times could be investigated and their trends can be seen.

Acknowledgment

This research was supported by Basic Science Research Program through the National Research Foundation of Korea (NRF) funded by the Ministry of Education, Science and Technology (2011-0006548).

This research was supported by Basic Science Research Program through the National Research Foundation of Korea (NRF) funded by the Ministry of Education, Science and Technology (2015R1D1A1A01057607).

This work was supported under the framework of international cooperation program managed by National Research Foundation of Korea (2016K2A9A2A06004689).

This research was supported by Basic Science Research Program through the National Research Foundation of Korea(NRF) funded by the Ministry of Education(NRF-2018R1D1A1B07041627).

References

[1] C. Schmandt, and S. Marzi, Effect of crack opening velocity and adhesive layer thickness on the fracture behaviour of hyperelastic adhesive joints subjected to mode I loading, *International Journal of Adhesion and Adhesives*, 83 (2018) 9-14.

[2] M. Demiral, and F. Kadioglu, Failure behaviour of the adhesive layer and angle ply composite adherends in single lap joints: A numerical study, *International Journal of Adhesion and Adhesives*, 87 (2018) 181-190.