Proceedings IRF2018: 6th International Conference Integrity-Reliability-Failure
Lisbon/Portugal 22-26 July 2018. Editors J.F. Silva Gomes and S.A. Meguid
Publ. INEGI/FEUP (2018); ISBN: 978-989-20-8313-1

PAPER REF: 7238

DAMPING PROPERTIES OF CORK/FIBRE REINFORCED POLYMER COMPOSITES

Ali Daliri[1,2(*)], Tahsin Anowar[1], Jose Silva[1]
[1]School of Engineering, RMIT University, Melbourne, Australia
[2]Defence Materials Technology Centre (DMTC), Hawthorn, Australia
[(*)]*Email:* ali.daliri@rmit.edu.au

ABSTRACT

Cork is a natural and renewable material which has found applications in various industries for more than 5000 years. In this study, the effect of embedding cork particles with various sizes, weight percentages, and locations on vibration characteristics of composites was investigated. The results show that cork granules increase the loss factor in fibre composites where particle size has slight influence on its performance.

Keywords: cork, composite, damping, S2-glass.

INTRODUCTION

Cork is a renewable, natural and viscoelastic material which exhibits excellent energy absorption capabilities, making it a viable candidate when vibration suppression and damping characteristics are major design requirements. However, the effect of adding such a viscoelastic material to enhance the damping characteristic of fibre reinforced composites has not been widely explored. Whilst, previous research shown that size of cork granules can affect mechanical properties of composites, such an effect has not been investigated on damping characteristics of composites.

This paper investigates the damping characteristics of cork reinforced composites with potential applications in aerospace and automotive industry. Cork granules with different sizes were added to S2-glass fibre/phenolic resin composite at different locations of the laminate with varying weight percentages. Samples were prepared using vacuum assisted resin infusion technique. Vibration tests were conducted using ASTM standard E756. Composite samples with 0% cork inclusion were used as control.

RESULTS AND CONCLUSIONS

Table 1 shows the nine configurations that were used in the experiments. For samples with cork granules embedded underneath the surface of composite, the laser vibrometer measured the response of material from this surface. Figure 1 shows the measured loss factor of all nice sample configurations. The addition of cork to fibre reinforced composite improved the damping characteristic of the material. In addition, Figure 1 shows the effect of particle size and location of the loss factor of composite. The location of cork granules and their weight percentage are more important than the size of particles in determining the loss factor of composite.

Table 1 - Test matrix

Sample No.	Cork Granule size (mm)	Cork Content (wt%)	Cork Location
1	NA	0	NA
2	0.5-1.0	5	underneath surface
3	0.5-1.0	10	underneath surface
4	0.5-1.0	5	mid-plane
5	0.5-1.0	10	mid-plane
6	1.0-2.0	5	underneath surface
7	1.0-2.0	10	underneath surface
8	1.0-2.0	5	mid-plane
9	1.0-2.0	10	mid-plane

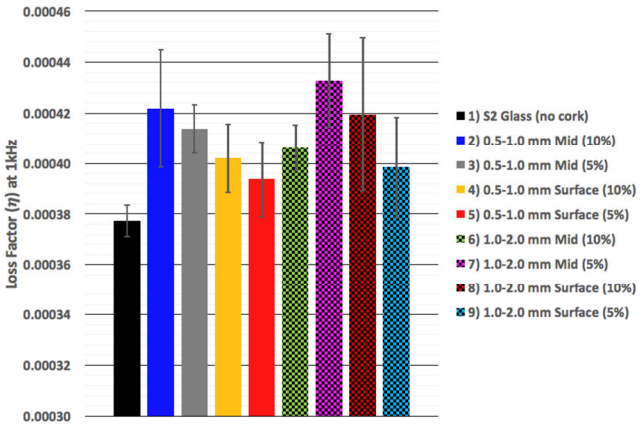

Fig. 1 - Mean loss factor of samples 1-9 at frequency of 1 kHz

This study shows that the addition of cork granules to fiber reinforced composites increase the vibration loss factor of the material. Furthermore, the results suggest that the most important factors are weight percentage and location of cork particles. Further experiments are required to determine other dynamic properties of cork/fibre reinforced composite materials.

ACKNOWLEDGMENTS

This research was conducted within the Defence Materials Technology Centre (DMTC), which was established and is supported by the Australian Government's Defence Future Capability Technology Centre (DFCTC) initiative.

REFERENCES

[1] Ben Abdallah F, Ben Cheikh R, Baklouti M, Denchev Z, Cunha, AM. Effect of surface treatment in cork reinforced composites. J Polymer Research, 2009, 17, pp. 519-528.

[2] Castro O, Silva JM, Devezas T, Silva A, Gil L. Cork agglomerates as an ideal core material in lightweight structures. Materials & Design, 2010, 31, pp. 425-432.

[3] Koruk H, Sanliturk KY. On measuring dynamic properties of damping materials using Oberst beam method. American Society of Mechanical Engineers, pp. 127-134.

[4] Potes FC, Silva JM, Gamboa PV. Development and characterization of a natural lightweight composite solution for aircraft structural applications. Composite Structures, 2016, 136, pp. 430-440.