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Tube enhanced foam: A novel way for aluminum foam enhancement

L. L. Yan^{1,2,3} Z. Y. Zhao² B. Han^{1,2,*} T. J. Lu² B.H Lu¹

1 School of Mechanical Engineering, Xi'an Jiaotong University, Xi'an 710049, China

2 State Key Laboratory for Strength and Vibration of Mechanical Structures, Xi'an Jiaotong University, Xi'an 710049, China

3 Air Force Engineering University, Xi'an 710051, China

** Corresponding author. E-mail: hanbinghost@qq.com*

Abstract: Aluminum foam was limited when applied as load carrying structures for its lower strength. Therefore, an effective enhancement method of aluminum foam was reported in the present study by filling of 304 stainless steel tube into a pre-perforated hole and fixed by epoxy glue. The experimental results indicate that the novel tube enhanced foam (with equivalent density of foam) can doubled the specific compressive strength and energy absorption of that of aluminum foam, and even larger than that of the sum of tube and foam which were tested separately. The coupling strengthening mechanisms are suggested to be the instability limitation of steel tube due to the lateral supports (external and internal) supplied by aluminum foam.

Key words: Porous materials; structural; tube enhanced foam; compressive strength; energy absorption.

1. Introduction

Aluminum foam is widely studied and applied in lightweight structural and functional applications for its exceptional mechanical, acoustic, and thermal insulation performances, particularly for its excellent energy absorption properties [1-3], such as crash absorber box of car[3]. In addition, it also has advantages in machining and joining process [4, 5]. However, due to its high porosity and inevitable fabrication defects [6], the low strength of aluminum foam limits its engineering applications applied as load carrying structures. Therefore, lots of effective efforts have been made to increase the mechanical properties of aluminum foam via adding

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