A STUDY ON DAMPING CAPACITY OF ALUMINIUM-BASED METALLIC FOAM

Bălțătescu Oana[1], Chicet Daniela[1*], Axinte Mihai[1], Bujoreanu Carmen[2]

[1*] *Technical University of Iasi, Materials Science and Engineering Department, 41 D.Mangeron Blvd, Iasi, Romania, e-mail: daniela_chicet@yahoo.com*
[2] *Technical University of Iasi, Mechanical Engineering Department, 6 D. Mangeron Blvd, Iasi, Romania*

Abstract: *Metallic foams (referred in literature as metfoams), represent a relative new category of materials, yet unknown to the large engineering world. They present new physical, mechanical, thermal, electrical and acoustic properties and they are material with low densities. Hence, they offer potential for lightweight structures, for mechanical and/or thermal energy absorption, most of foams having a low production cost. Nowadays, metallic foams are incompletely characterised and the production processes are still in the stabilization stage, thus resulting some properties variations. At this point of time, the most commercially available foams are produced from aluminium and nickel alloys.*

In the present paper it was investigated the damping capacity of an aluminium-based metallic foam, manufactured by the procedure of melting the alloy onto a salt bed.

Keywords: *metallic foams, damping capacity, aluminum alloys*

1. Introduction

It is well known that the fundamental property which stands at the base of designing and manufacturing structural components for dynamic applications is the damping capacity. This, because the vibrations, which affects a wide range of structure (from large structure as aircrafts to small ones as electronics) could be reduced increasing the damping capacity (expressed by the loss tangent – tan δ). The materials with good damping capacity are needed because they are able to diminish the mechanical vibration and wave transmission, thus reducing the noise, increasing the structural systems stability, durability, position control and performance [1].

The damping property of a structure can be obtained using the passive methods (the inherent ability of certain materials to absorb vibration energy providing passive energy dissipation – for example, through mechanical deformation) or the active methods (using sensors or actuators to suppress the vibrations in real time) [2].

The usual materials with vibration damping capacity are mainly metals and polymers. The damping mechanism is based on the viscoelastic character and also on the microstructure of materials. It is about the existence of internal defects (dislocations, phase boundaries, grain boundaries and various interfaces) which dissipate energy as a result of surfaces slipping with respect to one another during vibration modes [3].

One of such materials is the aluminum alloy foams, which have become an interesting material class for more than twenty years, because of its enhanced energy absorption and lightweight. There are several research challenges regarding the mechanical behavior of metallic foams, from the scientific point of view: inhomogeneous structure, complex non linear behavior, strain-rate, density and hydrostatic stress tensor sensitivity [4, 5, 6].

The foams have a polyhedral cellular microstructure and density values between 1% and 15% [7] (density is calculated as the report density of foam/density of base material). The aluminum foams could have open-cells (when the material is concentrated in the nearly straight edges of the polyhedra and in the nodes at which they intersect) or closed-cells (when the cell faces are covered with thin membranes or plates) [8].