Flexible Die as Reinforcement for Aluminum Foam Samples

A. Viscusi[1,a)], L. Carrino[1,b)], D. De Fazio[1,c)], M. Durante[1,d)], A. Formisano[1,e)]

[1]*Department of Chemical, Materials and Production Engineering, University of Naples Federico II, Piazzale V. Tecchio 80, 80125 Napoli, Italy*

[a)]Corresponding author: antonio.viscusi@unina.it
[b)]luigi.carrino@unina.it
[c)]dario.defazio@unina.it
[d)]mdurante@unina.it
[e)]aformisa@unina.it

Abstract. Metal foams are an interesting class of structural materials that have attracted increasing attention for many industrial applications thanks to their very unusual scientific properties. In particular, they are characterized by a relatively high degree of porosity, resulting in lightweight structures. Among the materials that can be processed for metal foams, aluminum alloys seem to be very effective to realise cell-structured systems with high specific strength and stiffness, unusual thermal and acoustic properties and good energy absorption ability, and the Powder Compact Melting technique is an effective metal powder-based indirect method commonly used to manufacture closed-cell aluminum foams. In the recent years, the possibility to improve the mechanical properties of metallic foams, without affecting their bubble internal structure, was investigated for several industrial applications. Unfortunately, several solutions, which provide a relatively high growth of the weight, are likely to compromise the concept of lightweight structure. In the light of this, the aim of the present activity was the manufacturing of enhanced closed-cell aluminum foam based samples for industrial applications such as security systems for the automotive field (e.g., anti-intrusion bars); as reinforcement, that constitutes also a flexible die, a stainless steel wire mesh was considered. The Powder Compact Melting technique was used for producing cylindrical samples, starting from a commercial foam precursor and replacing the conventional dies by the wire mesh, with the additional effect of foam reinforcement. Quasi-static three point bending tests were performed to determine the mechanical behaviour of these reinforced and lightweight samples, in order to compare their properties with the ones of plain foam samples. Finally, a component with a complex geometry was manufactured, aiming to evaluate the chance to use the proposed flexible dies as metal foam reinforcements in many instances.