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Additive Manufacturing (AM) technology offers the possibility to build strong and light components with complex structures, as lattice, optimizing the strength/mass ratio. The goal of this work is the characterization of an innovative sandwich panel with trabecular core made by Selective Laser Melting (SLM), used as heat exchanger for many industrial applications, for example in aerospace field. In this case study, the panel is integrated into the leading edges of aircraft wings and act as hot air anti-icing system and, at the same time, as impact absorber. The system, due to its lightness and shape, leads to the optimization of the heat exchange, the improvement of the thermal efficiency, and the reduction of fuel use and gas emission. A set of experimental and numerical tests is conducted on lattice specimens through a Design of Experiment (DOE). Different design parameters were varied to understand how they affect the mechanical and thermal behavior: six different cell shapes, varying cell size and volume fraction, were tested. The same experimental program is carried out for two different metal alloys: AlSi10Mg and Ti6Al-4V. Mechanical tests involve compression test on single core and on the whole panel, flexural and impact test. Further analysis on failure mechanism is carried out by observation with optical microscope. Thermal behavior of the system is also investigated by preliminary thermal simulations, whose results are validated by experimental measuraments of the temperature gradients on the external surface.

Figure 1: *Schematic drawing of the panel integrated into the leading edge of wings.*

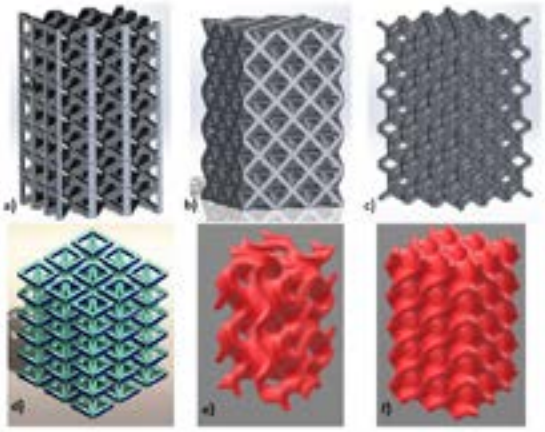

Figure 2: *3D models of specimens with different cell shapes: a) bccz, b) octet-truss, c) rombic dodecahedron, d) auxetic, e) Gyroid and f) schwarz diamond.*

Recent Publications

1. C G Ferro et al. (2017) A robust multifunctional sandwich panel design with trabecular structures by the use of additive manufacturing technology for a new de-icing system. Technologies. 5 (2):35. Doi:10.3390/technologies5020035.

Biography

Sara Varetti is a PhD student in the Department of Applied Science and Technology (DISAT) of Polytechnic University of Turin, Italy. Her reaserch activity is focused on characterization of materials used for Selective Laser Melting and in particular on aluminum alloys. Among her activities there is the design and characterization of an innovative anti-ice system for aircraft, which is patented. This study is carried out in collaboration with the Department of Mechanical Engineering and Aerospace (DIMEAS), Polytechnic University of Turin, Italy.

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