ID contributo: **114** Tipo: **Presentazione orale**

Impact of Thermal Treatments on the Static Behavior of Gyroid Lattice Structures Fabricated via Selective Laser Melting

mercoledì 3 settembre 2025 17:30 (15 minuti)

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Lattice structures are porous structures of growing interest, due to their fascinating performances, such as large specific surface area, low elastic modulus, and high stiffness-to-weight ratio. These advantages make lattice structures highly suitable for applications across various industries, including biomedical, automotive, and aerospace; all sectors where fatigue strength is crucial for extending service life.
Among lattice structures, triply periodic minimal surface structures (TPMS) have demonstrated superior mechanical properties compared to their equivalent strut-based ones. However, accurately fabricating these complex geometries remains challenging with conventional manufacturing methods.
This study aims at investigating the static behaviour of Ti6Al4V gyroid-type lattice structures produced through selective laser melting (SLM). The effects of different thermal treatments above 700℃ are evaluated in terms of microstructure. Static compression tests are performed to assess the impact of these treatments on lattice mechanical properties: the samples subjected to a heat treatment at temperatures above 900℃ exhibited greater toughness and a lower yield strength.

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Classifica Sessioni: Additive Manufacturing

Classificazione della track: Additive Manufacturing