ID contributo: **177** Tipo: **Presentazione orale**

# Effects of relative density and post-processing treatments on the compressive fatigue behavior of Ti6Al4V lattices

*giovedì 4 settembre 2025 11:00 (15 minuti)*

Academia and industry have been shown in recent years an increasing interest in lattices realized through additive manufacturing (AM). Such architecture porous structures have a behaviour influence by various factors, including unit cell topology, base material, heat treatments, and relative density. In the present work, an experimental campaign regarding the compressive mechanical behaviour of AM solid-based gyroid lattices made of Ti6Al4V alloy is presented. The work directly investigates the effects of the relative density through specimens characterized by different relative densities values (12.5%, 25%, 37.5%, and 50%); moreover, two sets of specimens per each relative density have been realized to evaluate the effect of two different post-treatment techniques; in particular, the HIP process have been considered to assess if other cheaper solutions may lead to similar beneficial effects on the fatigue properties when dealing with lattices. Micro-CT scans, microstructural, postmortem analysis and finite element analysis are included to better interpret the achieved results. Finally, a comparison with a wider fatigue dataset retrieved from literature is performed in an effort to obtain a more comprehensive understanding of the compressive behaviour of lattices. The results clearly showed that optimized process parameters and cheaper heat treatments ensures beneficial effects similar to those expected by HIP. Furthermore, accuracy and limitations of easy-to-use methodologies to account for the reduction in strength due to the change in relative density presented in literature, such as effective and normalized stress, have been evaluated.

**Autore principale:** Dr. FOTI, Pietro (Department of Chemical, Material and Environmental Engineering (DICMA), La Sapienza University of Rome, Piazzale Aldo Moro 5, 00185 Rome (Italy))

**Coautore:** Dr. ASTARAEE, Asghar Heydari (Department of Mechanical Engineering, Politecnico di Milano, Via L Masa 1, 20156, Milan (Italy)); Prof. BAGHERIFARD, Sara (Department of Mechanical Engineering, Politecnico di Milano, Via L Masa 1, 20156, Milan (Italy)); Prof. DU PLESSIS, Anton (Research group 3D Innovation, Stellenbosch University, Stellenbosch (South Africa); Comet Technologies Canada Inc, Montreal, Quebec (Canada)); Dr. WAN, Di (Advanced Research Institute of Multidisciplinary Sciences, Beijing Institute of Technology, Zhongguancun South Street 5, 100081, Beijing (China)); Prof. BERTO, Filippo (Department of Chemical, Material and Environmental Engineering (DICMA), La Sapienza University of Rome, Piazzale Aldo Moro 5, 00185 Rome (Italy)); Prof. RAZAVI, Nima (Department of Mechanical and Industrial Engineering, Norwegian University of Science and Technology (NTNU), Richard Birkelands vei 2B, 7049, Trondheim (Norway))

**Relatore:** Dr. FOTI, Pietro (Department of Chemical, Material and Environmental Engineering (DICMA), La Sapienza University of Rome, Piazzale Aldo Moro 5, 00185 Rome (Italy))

**Classifica Sessioni:** Additive Manufacturing

**Classificazione della track:** Additive Manufacturing