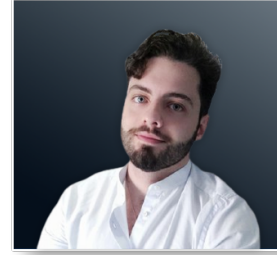


ADDITIVE MANUFACTURING: PRODUCTION, POST PROCESSING AND CHARACTERIZATION



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Curriculum: Tecnologie e Sistemi di Produzione

Additive Manufacturing (AM) is one of the most promising production techniques, depending on the materials and technology involved during processing, it is possible to investigate different problems and find new solutions that can fit specific requirements.

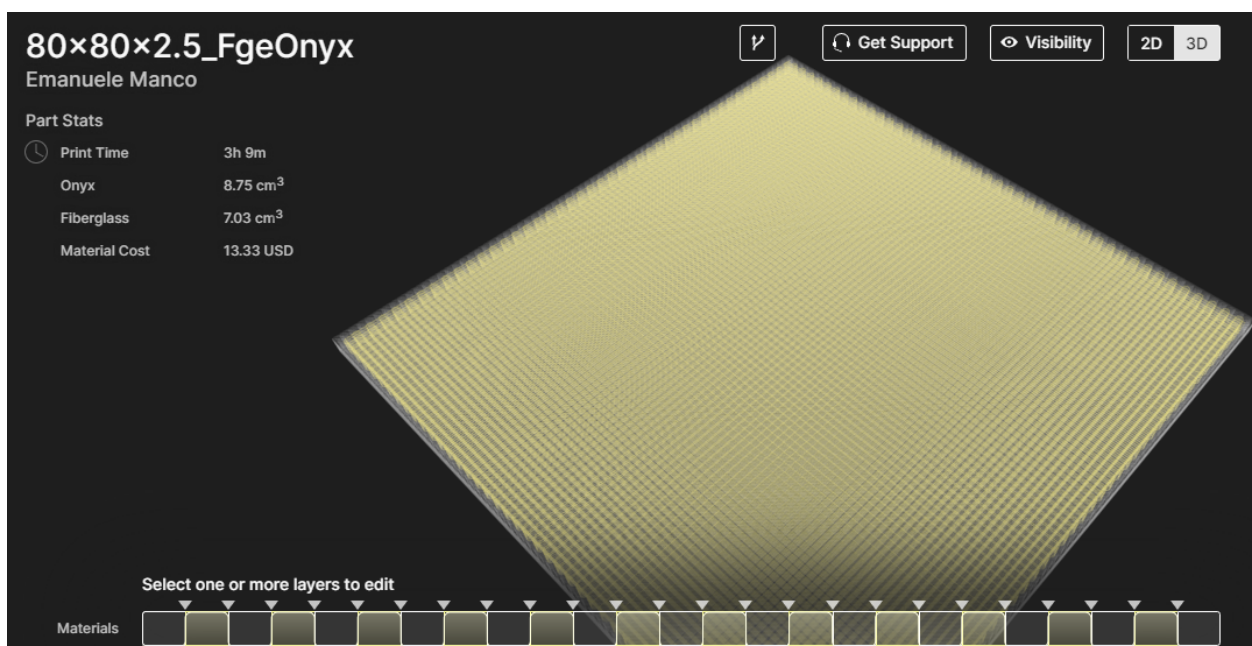
FDM Polymer Printing

Among our department equipment, three 3D printers using fused deposition modeling process are available. Two of them are extremely similar, they process mainly PLA (and other commercial thermoplastic materials) and their print parameters can be changed freely. The third one has two extruders and can print reinforced polymers, it can process Nylon or Onyx (a micro carbon fiber filled nylon) as matrix and different fibers as reinforcement (carbon fiber, glass fiber, Kevlar).

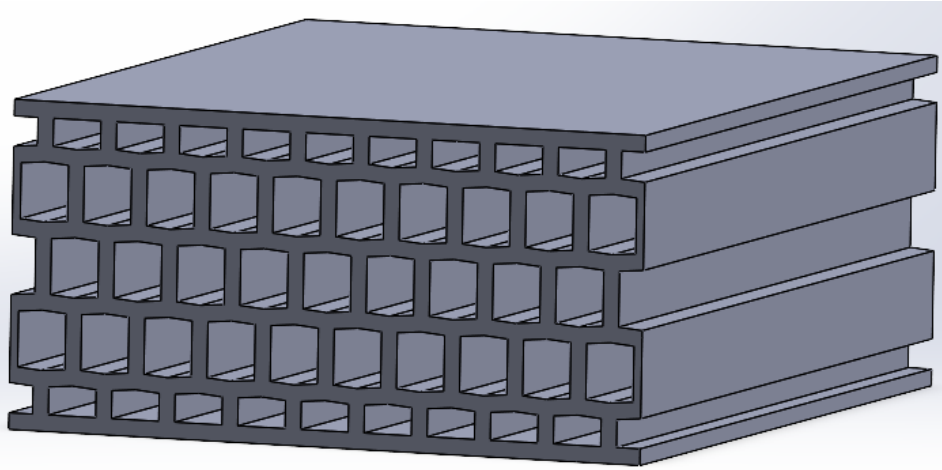
Since complex geometry is an AM perk, cellular solids theory study has been conducted, with particular interest for auxetic behavior.

Part of the research activity, hence, consists of studying 3D printed materials with the above-mentioned machines, particularly:

- Impact behavior and characterization of 3D printed fiber reinforced panels;
- Influence of print parameters on mechanical properties;
- Influence of geometric parameters on mechanical properties of additive manufactured cellular solids;
- Laser welding of additive manufactured joints with different shapes.



Schematic view of Onyx Glass Fiber reinforced panel on Eiger.io



3D model of cellular solid

Additive Manufactured Metals post processing and fatigue testing

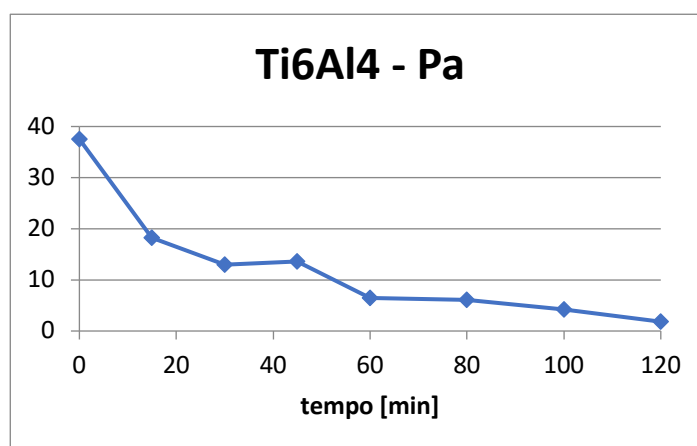
PhD activity also focuses on chemical milling of metal additive manufactured parts (mainly AlSi10Mg and Ti6Al4V), obtained both with SLM and EBM technique, to reduce the surface roughness (which is a huge drawback for powder bed-based AM technologies).

Besides chemical treatment, further surface finishing techniques will be studied, particularly laser polishing and abrasive fluidized bed machining.

An important aim of this part is validating the effectiveness of surface treatments through rotating beam fatigue tests and ultrasonic fatigue tests, which both are strongly influenced by surface quality.

To sum up, regarding this topic, the current activities are:

- Rotating beam fatigue tests of treated and untreated metal specimen.
- Ultrasonic fatigue tests of treated and untreated metal specimens.



Pa evolution during acid treatment over time.