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Thèse (FUI – INCAS), 2017 – 2020

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Lightweight hybrid co-continuous composites combining high stiffness and high damping

Context

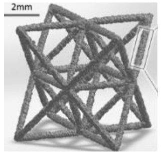
Aerospace industry

- Structural parts specifications:
  - Lightweight
  - High stiffness
- And during take-off
  - Low frequency (<100 Hz) vibrations
  - Need for vibration damping

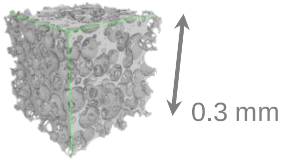
Objective

Design of a co-continuous hybrid composite combining these properties

Additive manufactured metallic lattice filled with viscoelastic polymeric foam



Ti-6Al-4V
(Arcam®)



Polyurethane (PU) foam *(Covestro®)*

Equipe PVMH

Method and tools

Elaboration – Strut scale

- **Electron Beam Melting (EBM)**
- **Conventional polymer foaming**
  - A+B components : mold + SpeedMixer ®

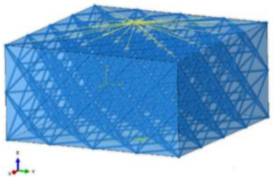
PU foam **TA6V halter** **Foamed halter**

Characterization

- **X-ray Tomography**
- **Dynamic Mechanical Analysis (DMA)**
  - Temperature and frequency sweep
  - Periodic compressive loading

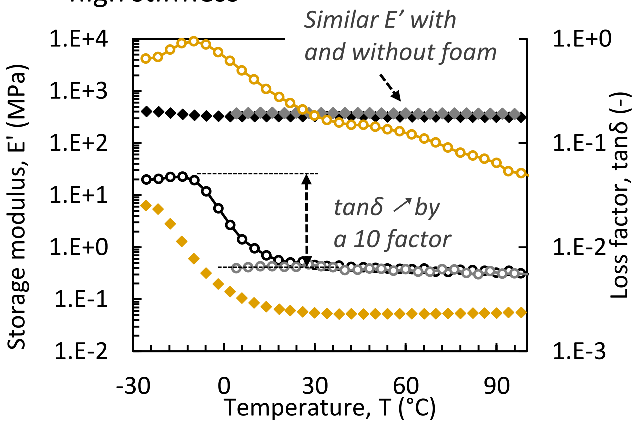
Numerical simulations

- Python scripts for Abaqus®
- Structure viscoelastic behavior with different lattices architectures



Results

- **Samples microstructure**
  - Foam homogeneity and relative density
  - Pore size and morphology
- **Composite viscoelastic properties**
  - Within Tg : Enhancement of the damping properties of the composite while keeping high stiffness



- **Prediction of the viscoelastic behavior of the composite**

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