Design of Porous PEEK Topologies Using Fused Filament Fabrication

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Materials

- Porous PEEK cubes were 3D printed using:
  - Apium P220
  - Victrex PEEK 450G
- Three Types of Cubes:
  - Solid (Control)
  - Gyroid
    - Pore Size: 450 µm, Strut Width: 0.25 mm, Porosity: 72%
  - Rectilinear
    - Pore Size: 600 µm, Strut Width: 0.25 mm, Porosity: 70%

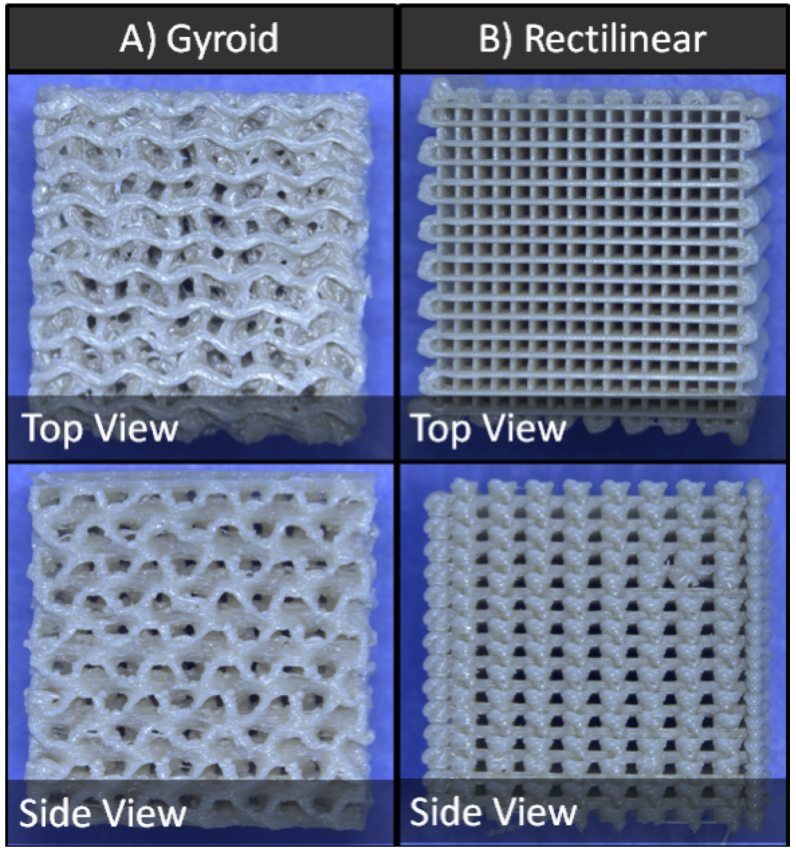

Figure 2: Top and Side Views of (A) Gyroid and (B) Rectilinear Topologies

Methods

- Micro-CT Imaging
  - Pore Size and Strut Width
- Dry Weight Method
  - Porosity
- Static Compression Testing
  - Young's Modulus
  - Compressive Yield Stress
- Falling Head Test Method
  - Permeability Coefficient

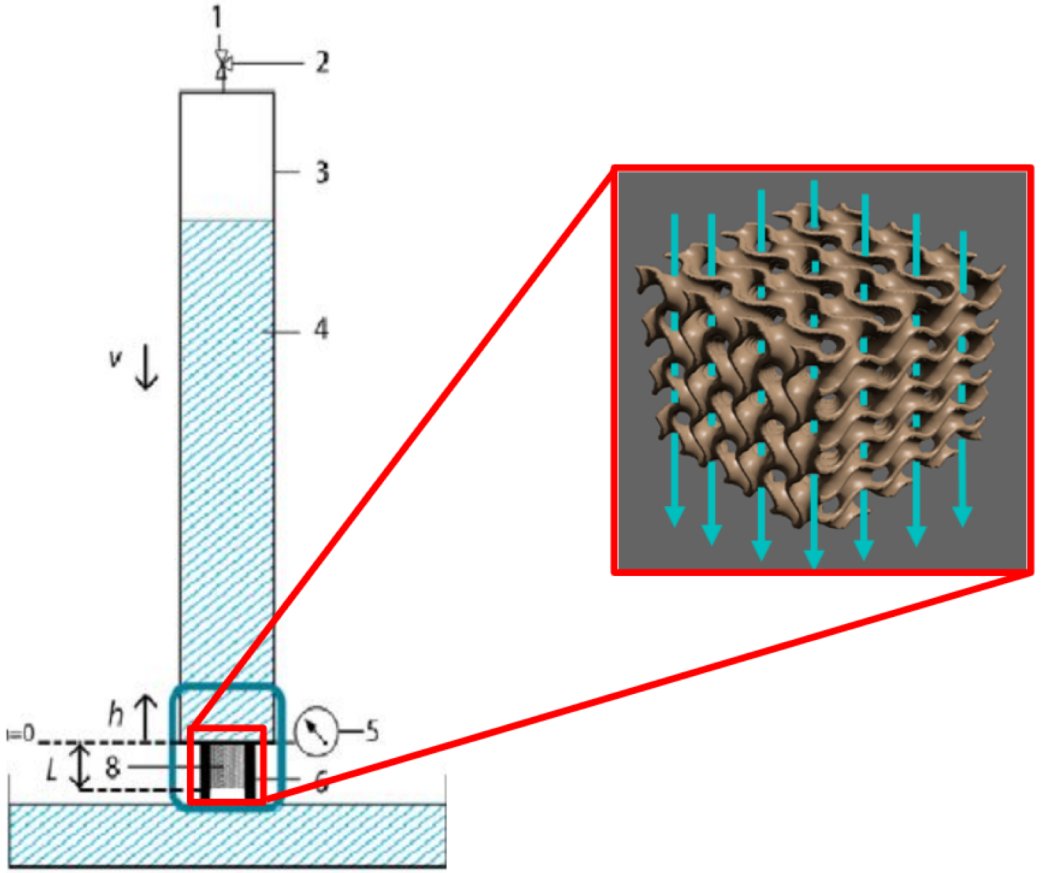

Fig. 16: Falling Head Test Method Diagram

Results

- Pore Size, Strut Width, and Porosity
  - Gyroid: 706 μm, 0.294 mm, 65.8%
  - Rectilinear: 589 μm, 0.293 mm, 73.2%
- Young's Modulus and Compressive Yield Stress
  - Gyroid: 237 MPa and 14.2 MPa
  - Rectilinear: 217 MPa and 7.36 MPa
- Permeability Coefficient
  - Gyroid: 557 μm^2
  - Rectilinear: 1500 μm

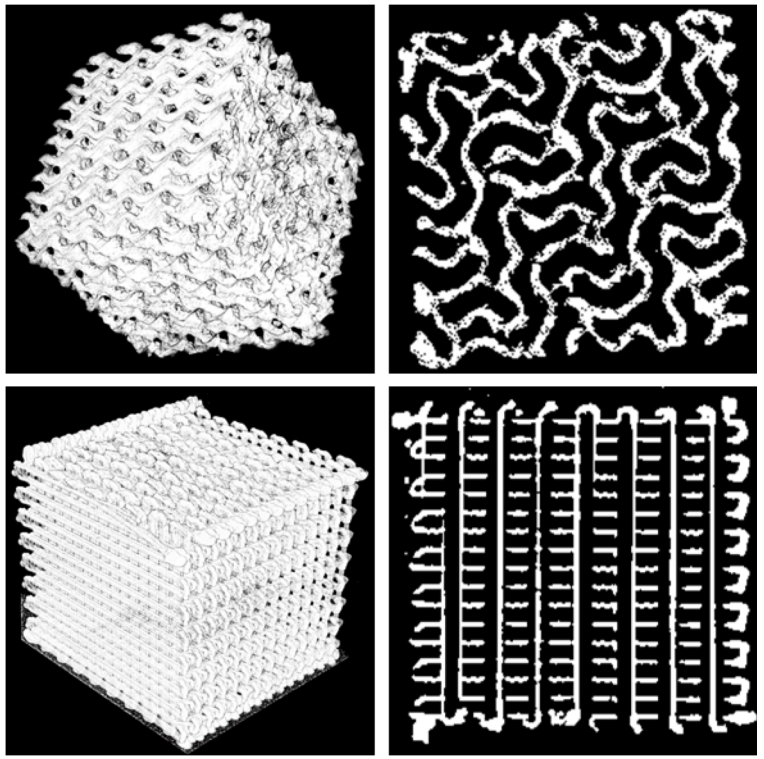

Figure 4: Micro-CT scans of reconstructed image of gyroid, 2D slice of gyroid, reconstructed image of rectilinear, and 2D slice of rectilinear