

Fabrication, structure and properties of carbon fiber reinforced magnesium metal foams

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Motivation

Application of porous metal structures in lightweight and structural engineering

High specific bending stiffness and strength

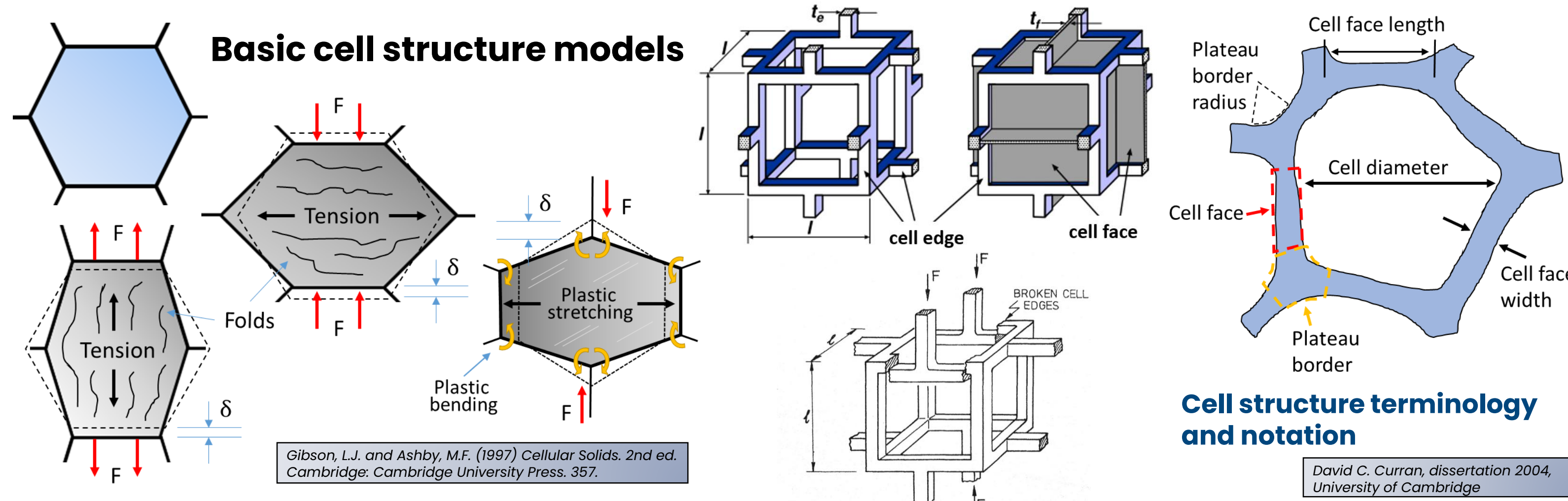
Light-weight

Good sound absorption, electromagnetic shielding, and vibration damping

High thermal stability and low thermal conductivity

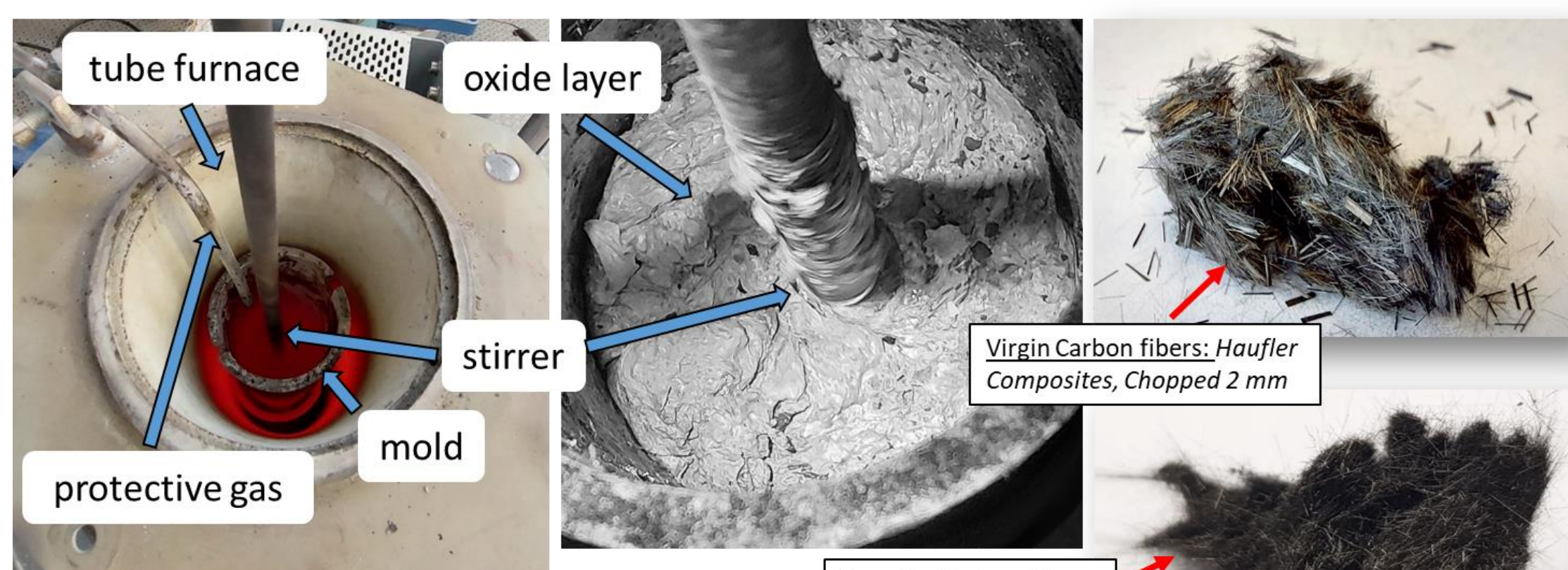
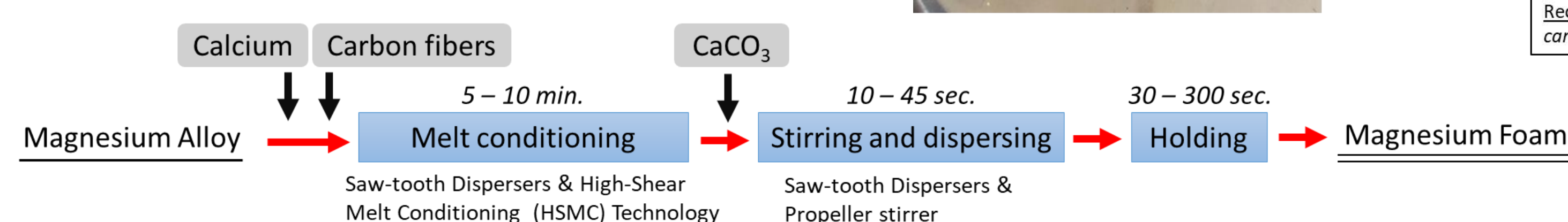
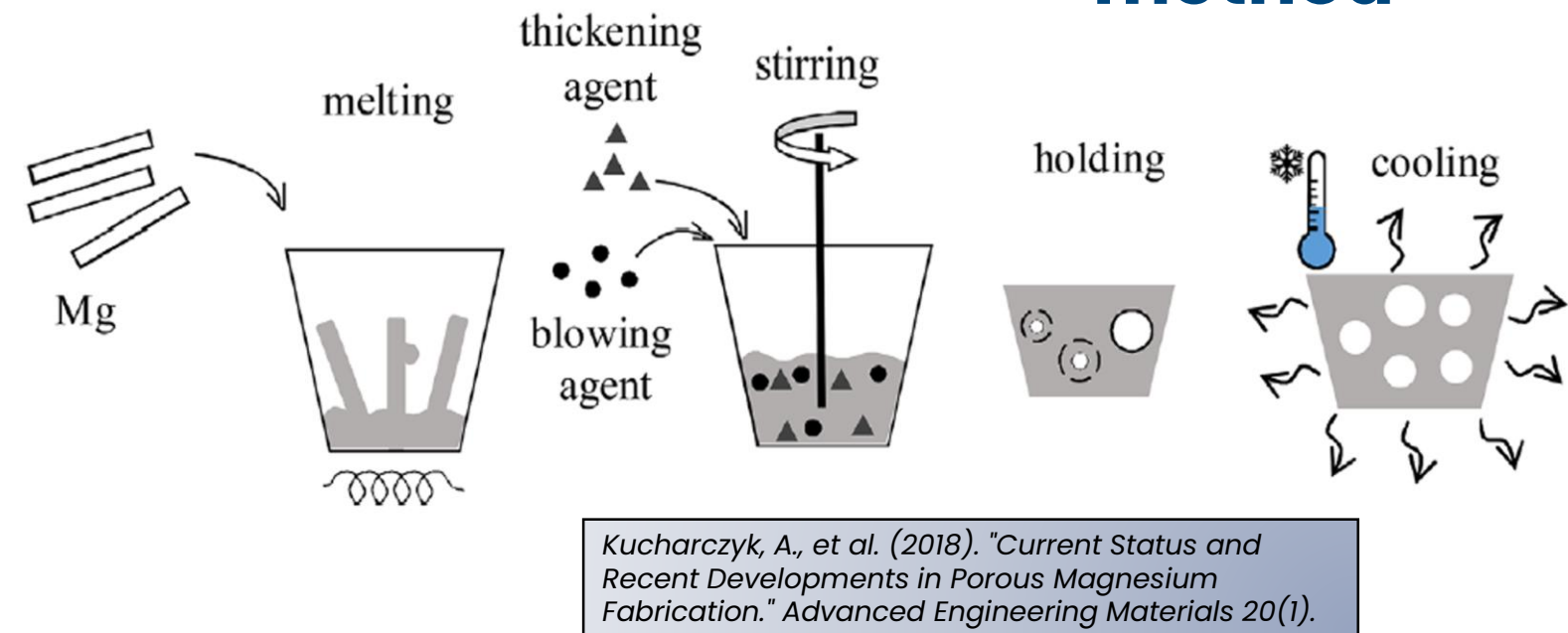
Isotropic absorption of impact energy at nearly constant low stress level

Körner, C. and R. F. Singer (2000) "Processing of Metal Foams: Challenges and Opportunities." Advanced Engineering Materials.

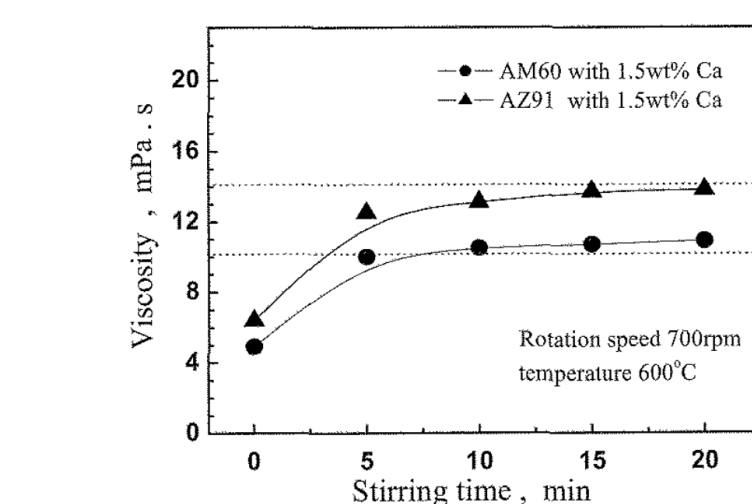
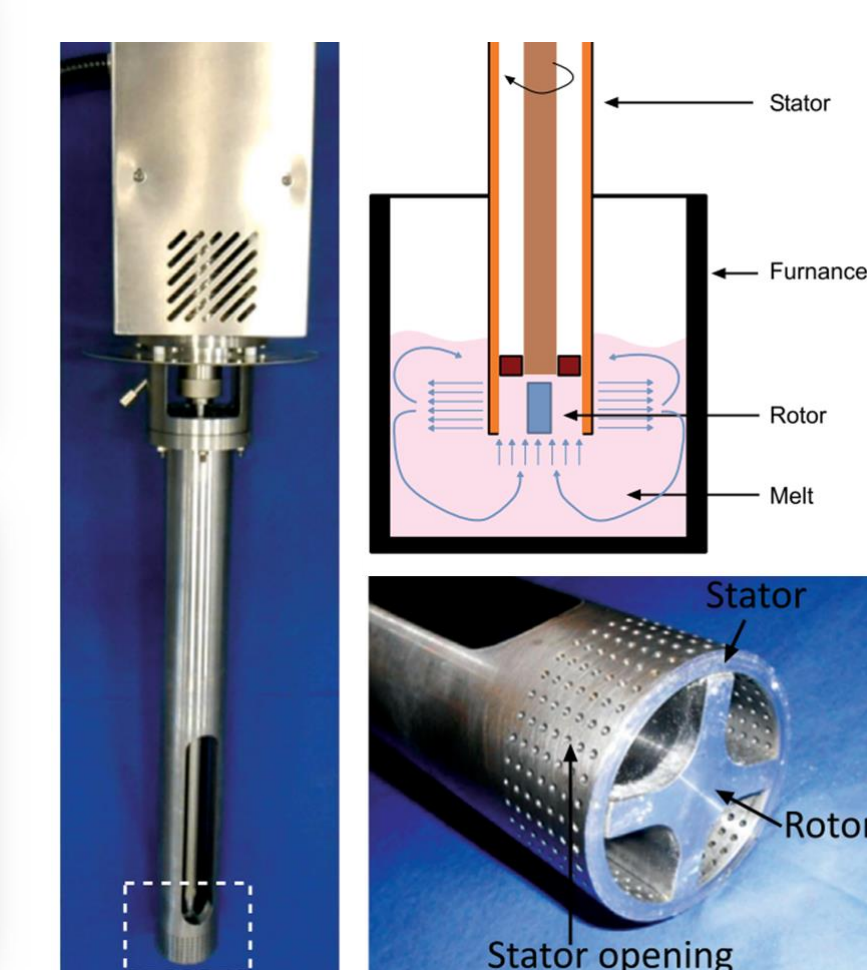


Processing

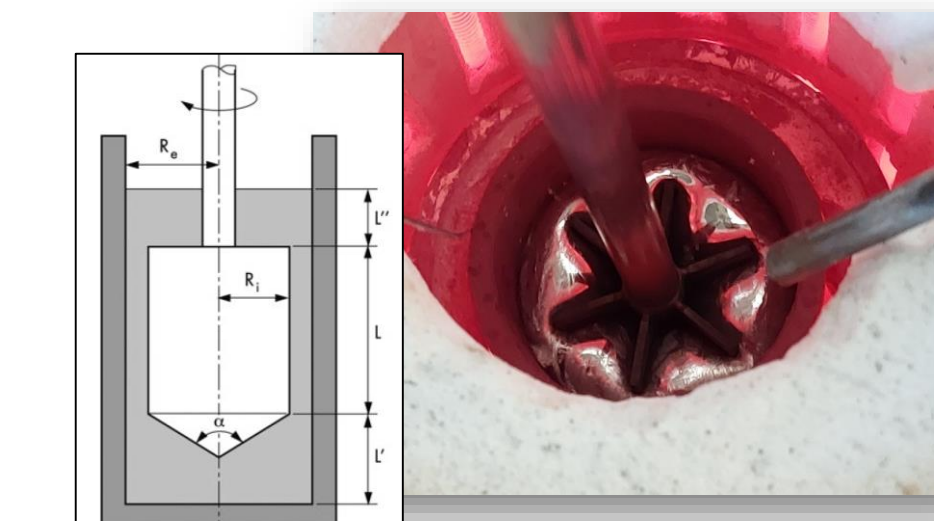
Melt foaming method



High Shear Technology for Liquid Metals Processing



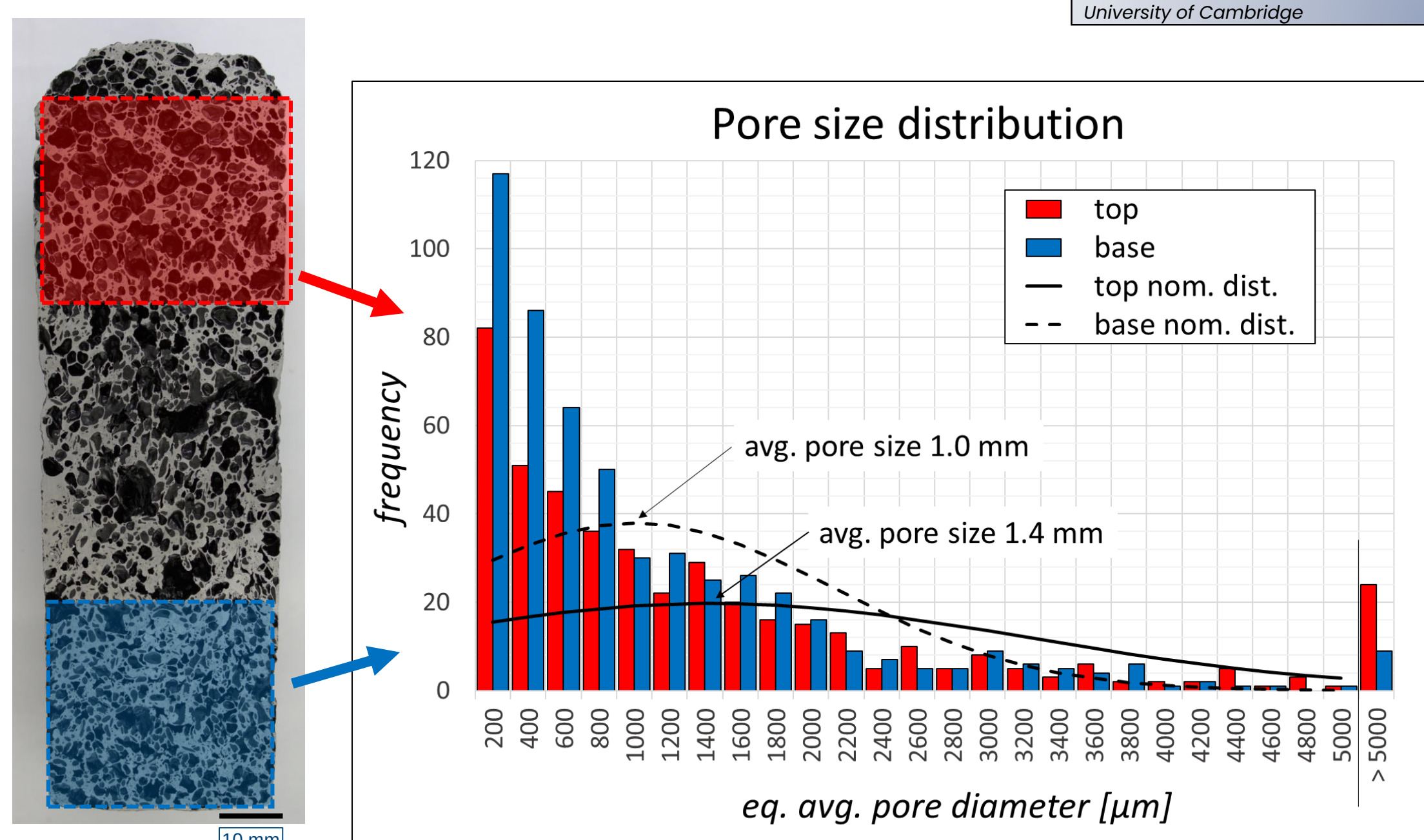
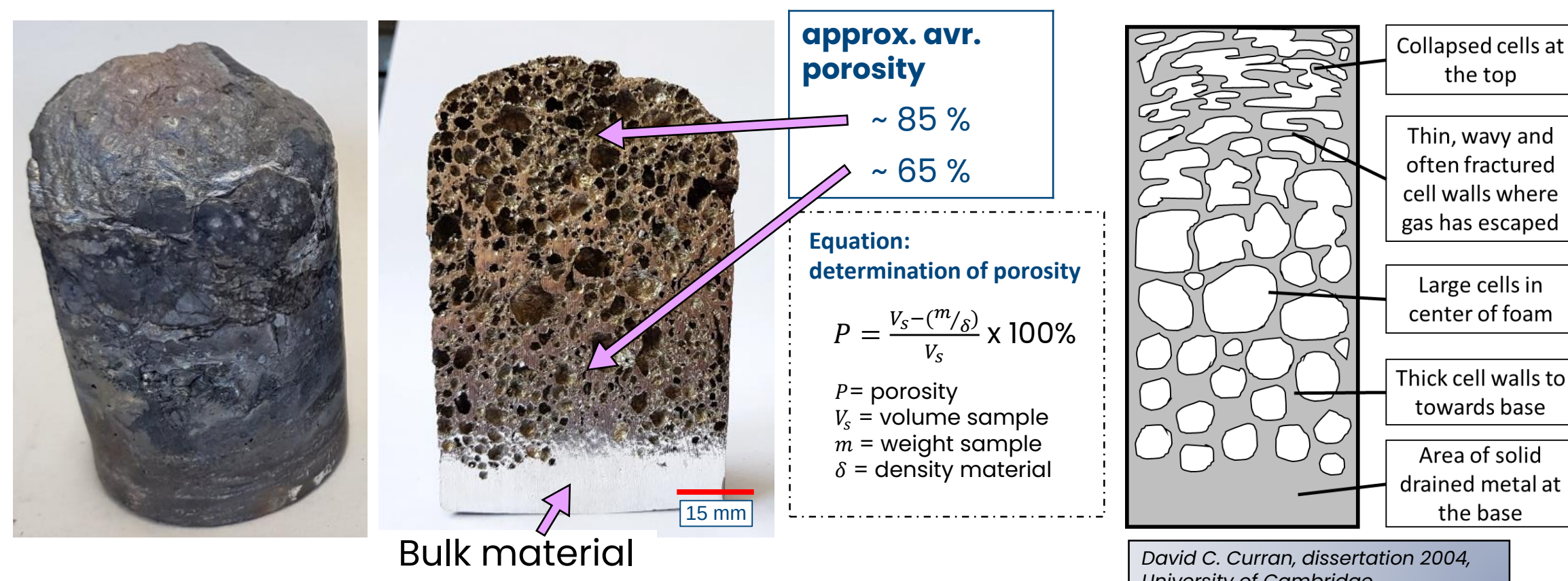
Relative viscosity measuring systems with paddle-shaped agitator



Characterization and Results

Characterization and evaluation according to the following important criteria:

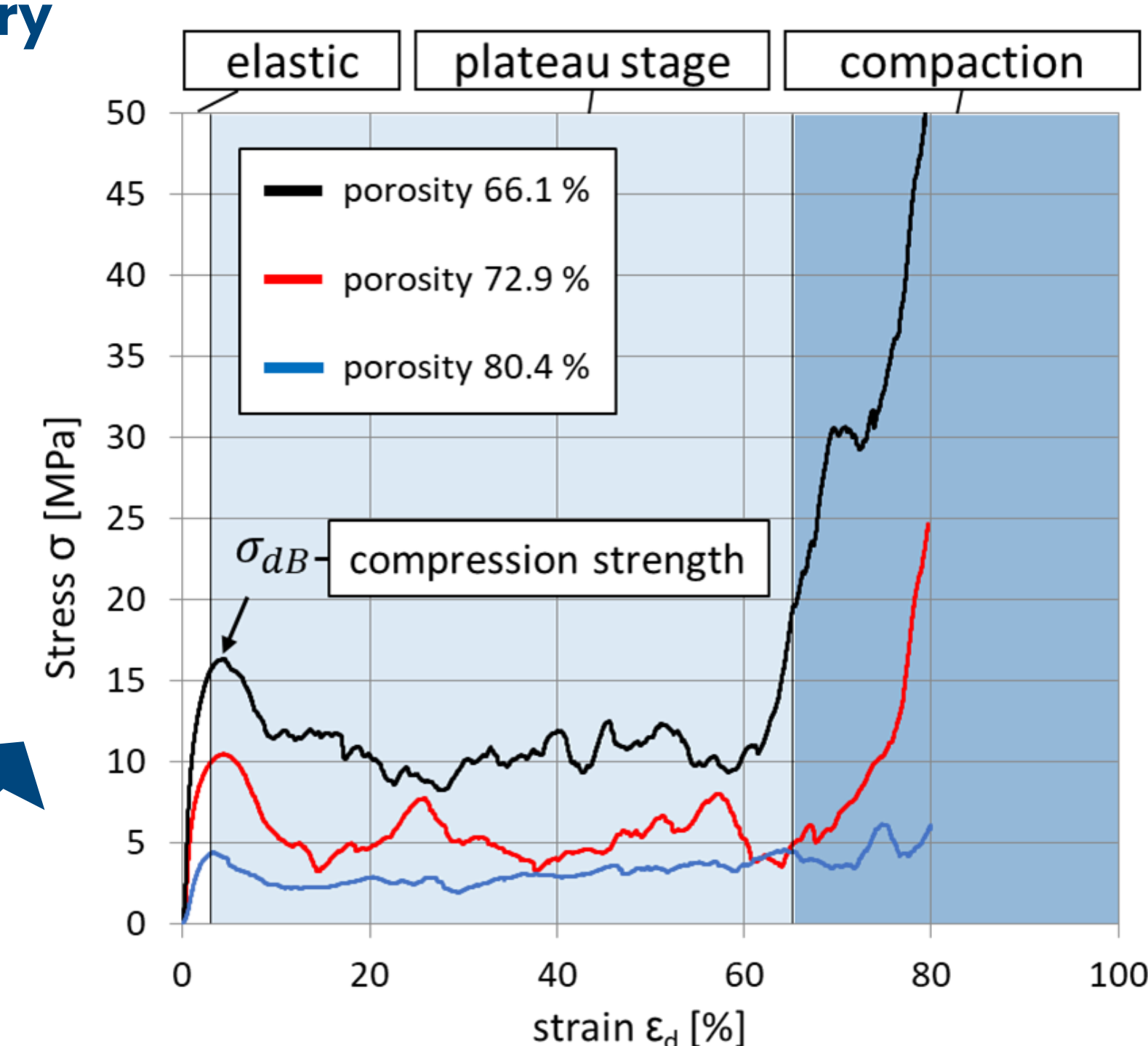
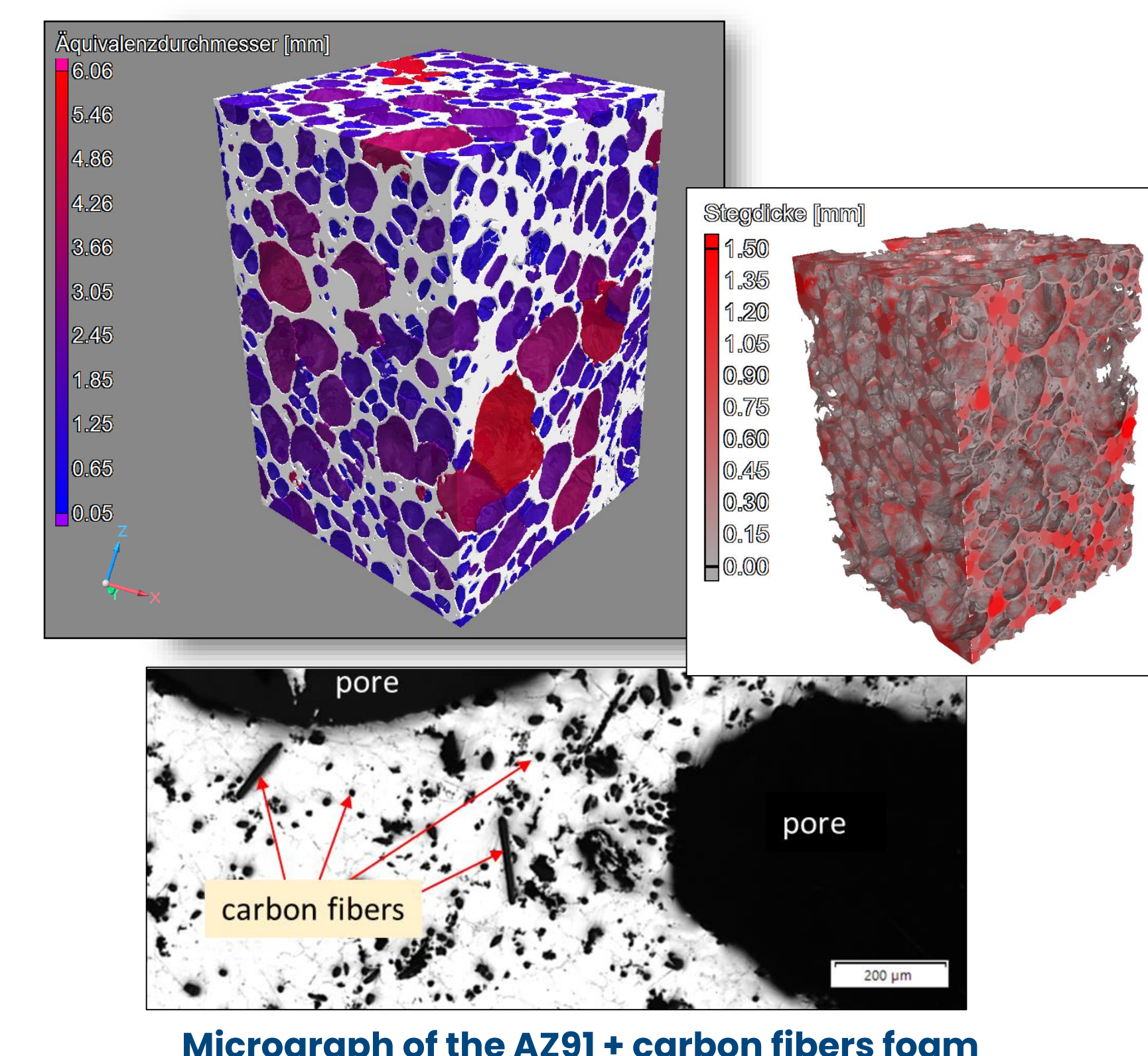
- global density
- foam structure
- matrix alloy
- foam microstructure
- pore size
- pore size distribution
- cell wall thickness



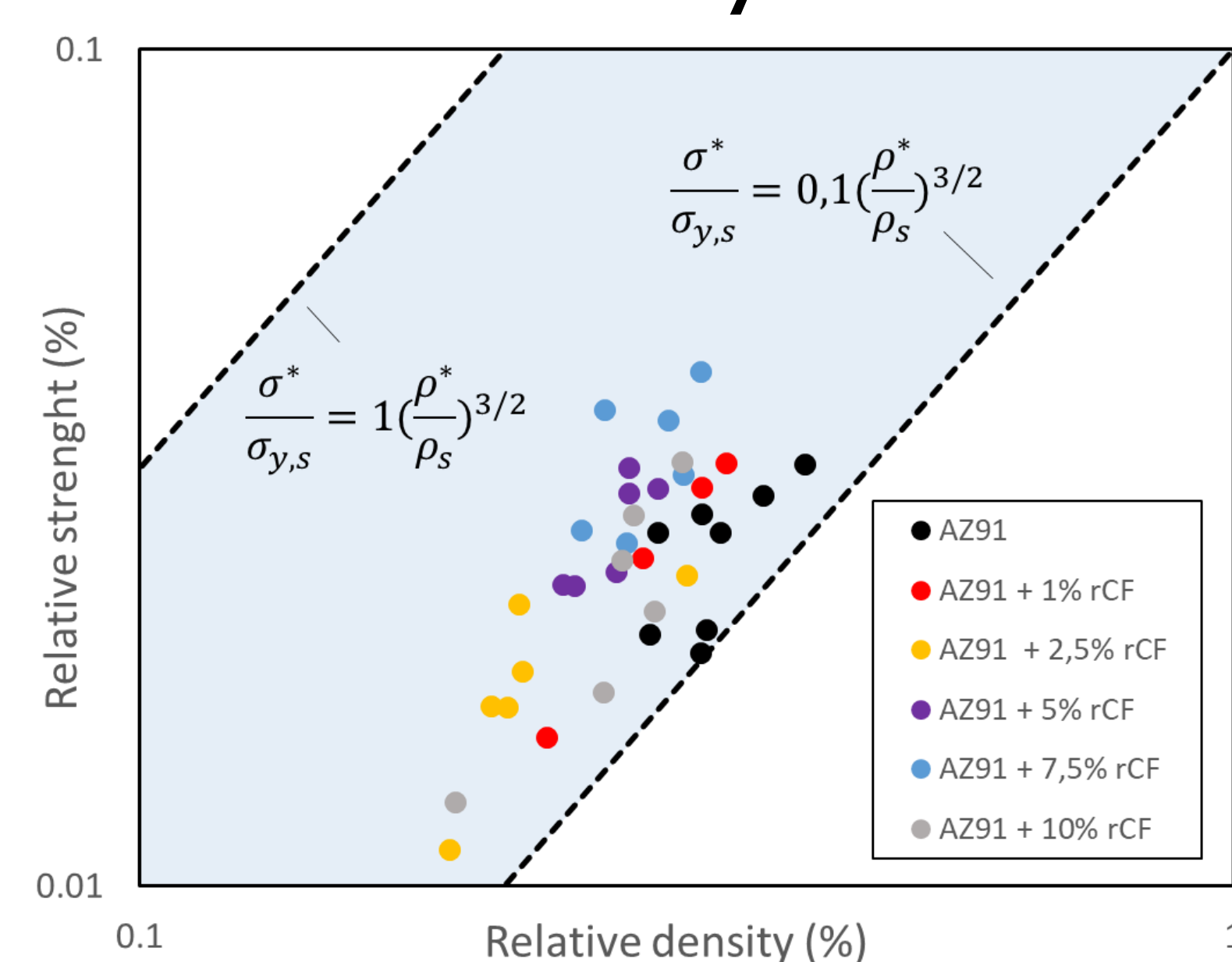
Compression test theory



CT-scan (X-ray computed tomography) to create a 3D model of the compression test sample



Gibson-Ashby model



Comparison of experimental compressive strength with predictions of the Gibson-Ashby model.

Summary

- Metal foams provide a promising portfolio of properties based on their unique porous structure.
- Due to its low density, this class of materials is particularly interesting for applications in lightweight construction, among others.
- The statistical and imperfect structure of the metal foams is a major challenge, especially for process control.

Research activities:

- General understanding of Mg-based and metal matrix composites foam structures.
- Influence of virgin & recycled carbon fibers on the ALPORAS® process and the mechanical properties of AZ91 magnesium foam.
- Combinations with other lightweight materials to develop hybrid components.

