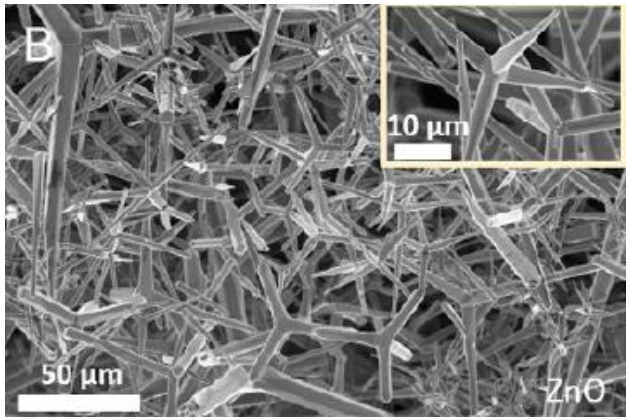
Christian-Albrechts-Universität zu Kiel
Technische Fakultät

Cells in functional porous materials

Michael Timmermann
Biocompatible Nanomaterials, University of Kiel

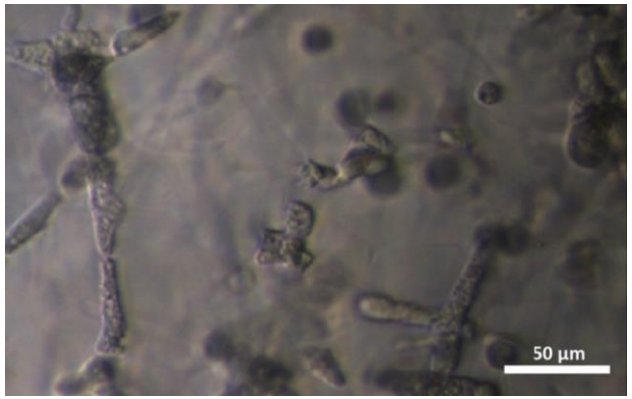
Porous Materials for tissue engineering

- 3D framework structures coated with bioactive nanoparticles



M. Taale, et al. *ACS Appl. Mater. Interfaces*, 2018, 10 (50), pp 43874–43886

- Soft porous scaffolds containing interconnected microchannels



S. Gutekunst, et al. *ACS Biomater. Sci. Eng.*, Just Accepted Manuscript

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Biomimetic strain-stiffening structures with possible applications in fracture treatment

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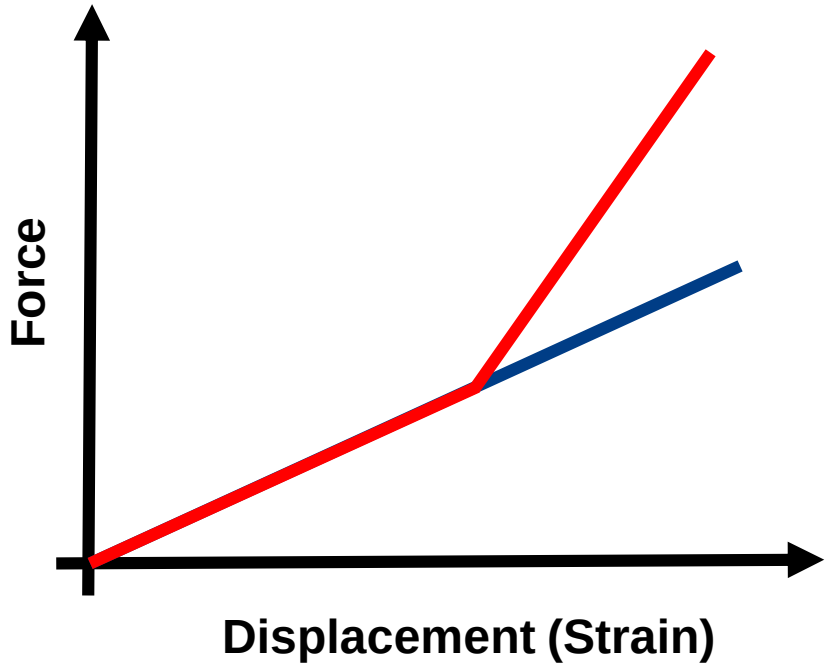
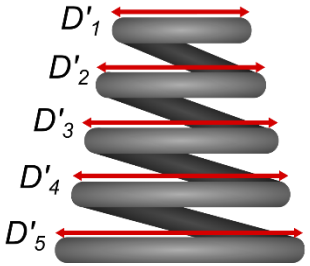
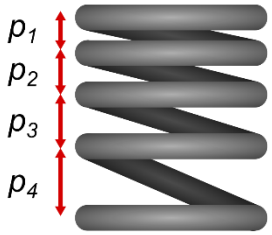
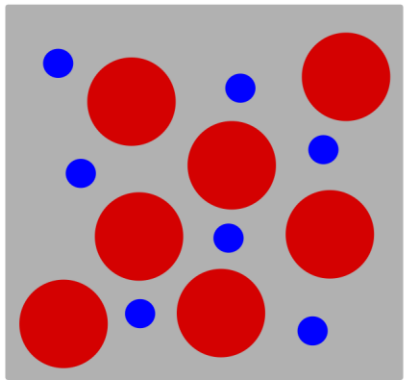
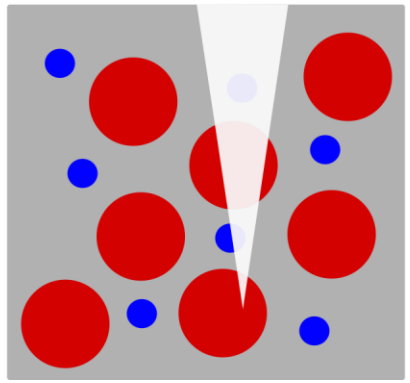
Strain-stiffening: An Introduction

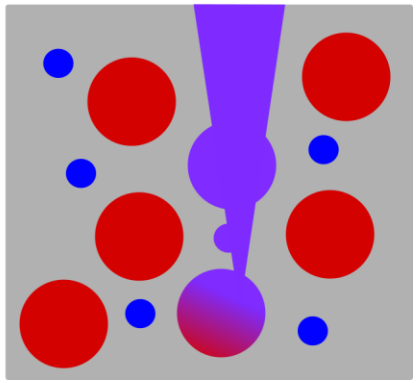








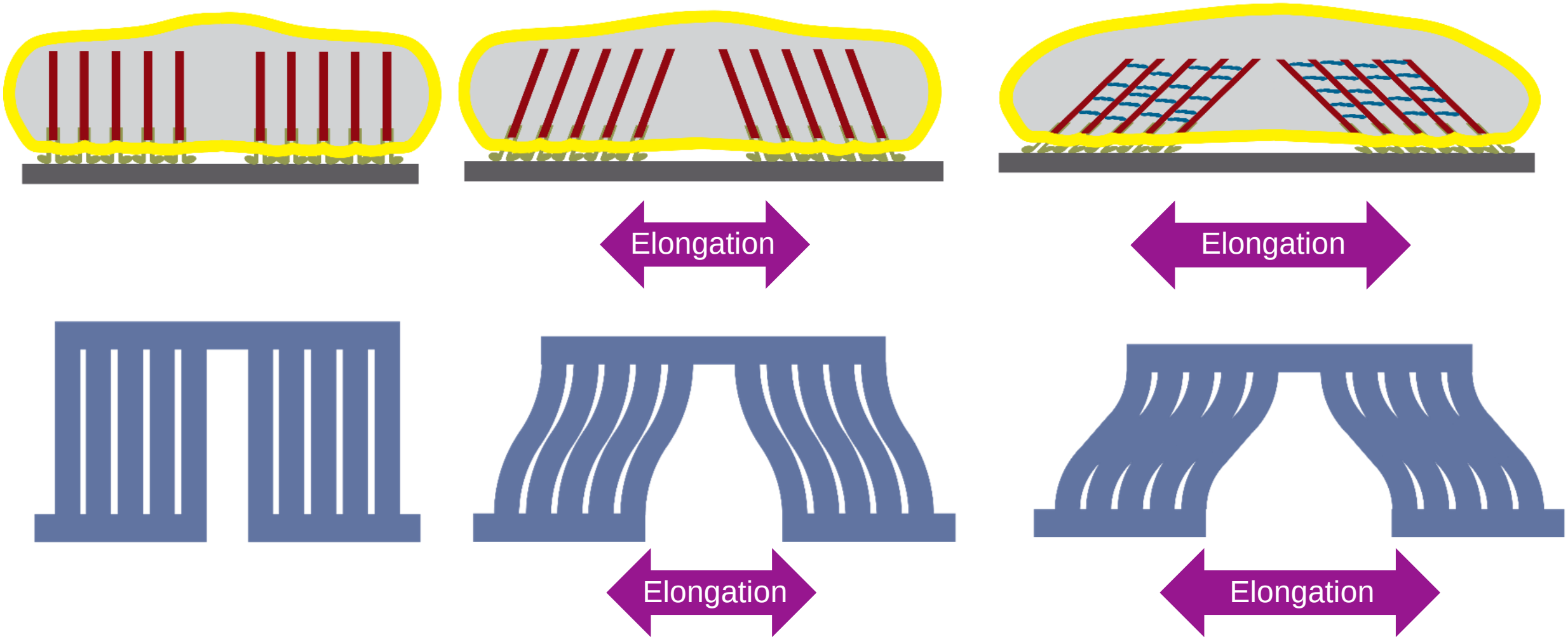




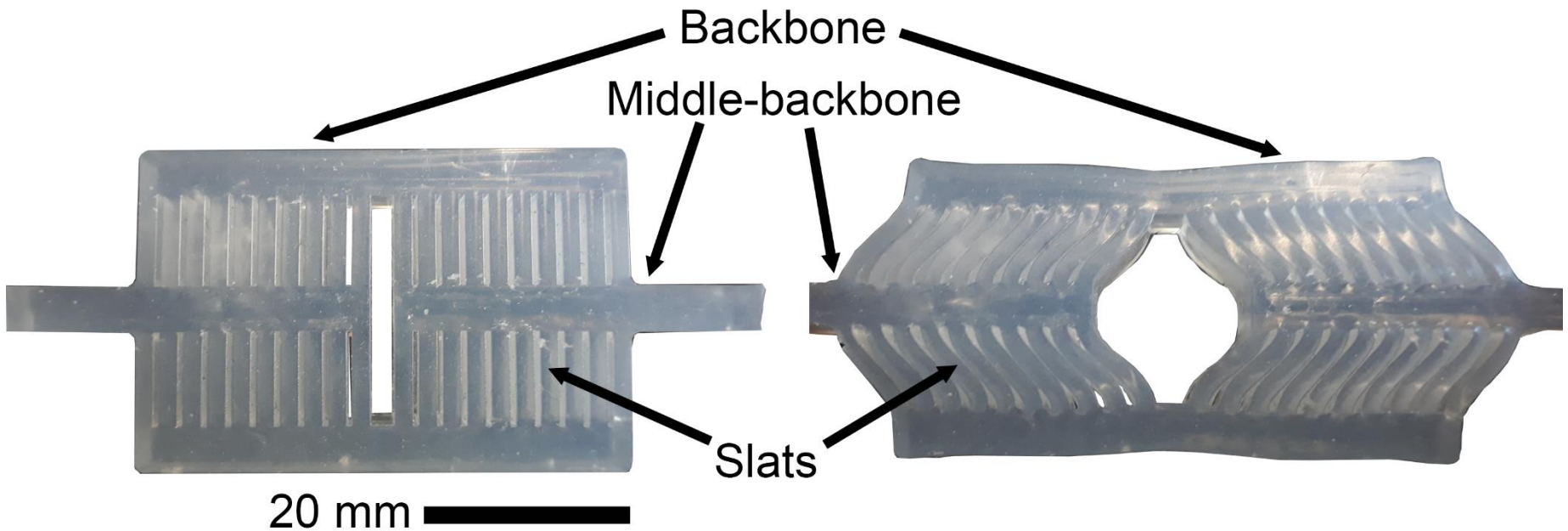
Problem: **Goal:**

- Stiffening upon elongation or compression
- Reversible
- Material independent
- Rate independent

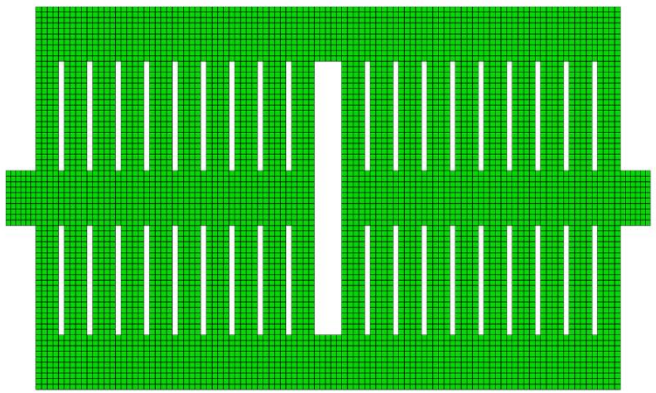
The biomimetic concept

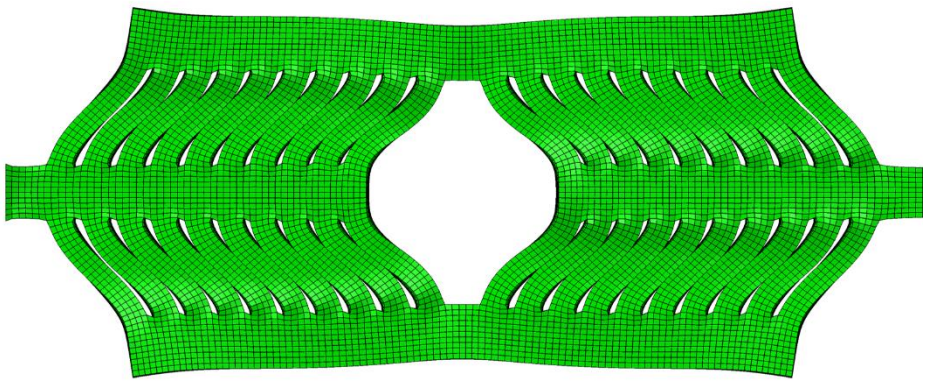


The structure



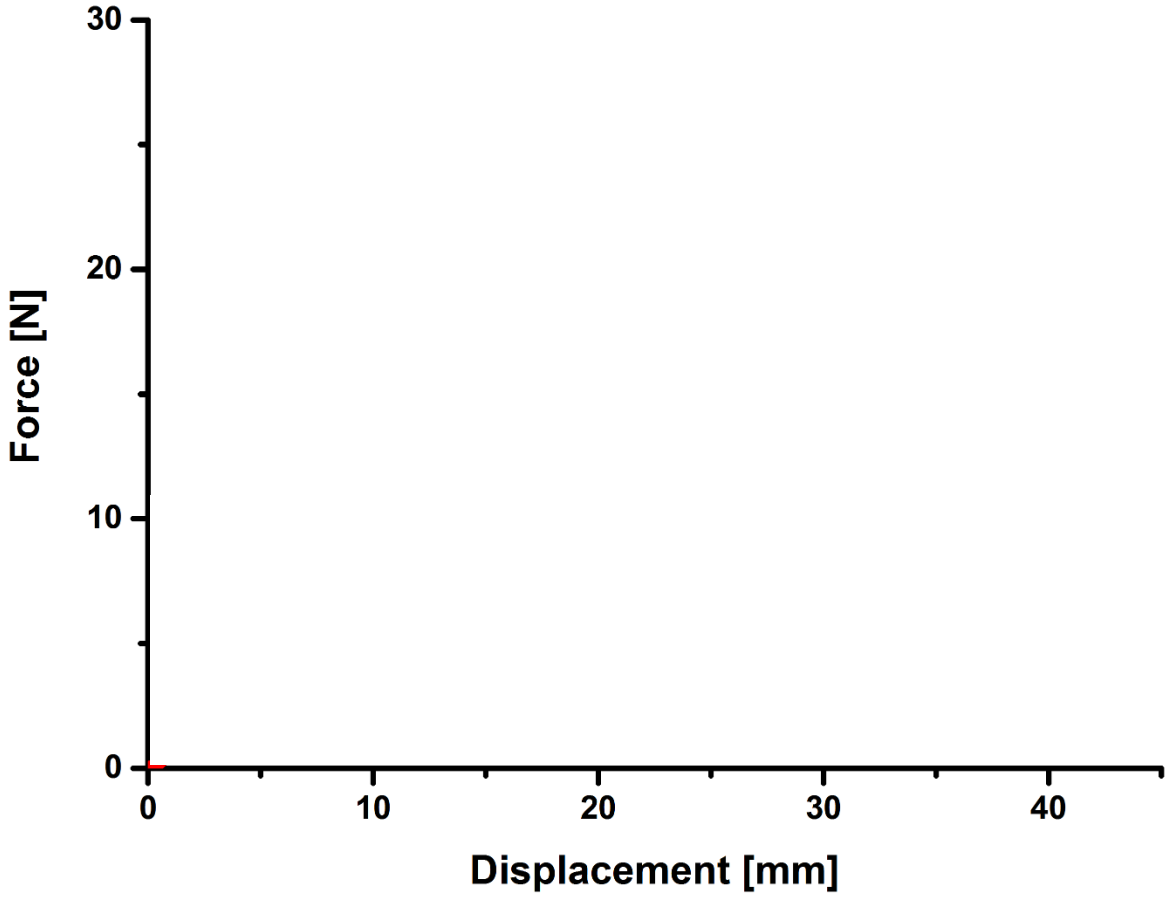
Material: Silicone Elastosil RT 625 (Wacker)

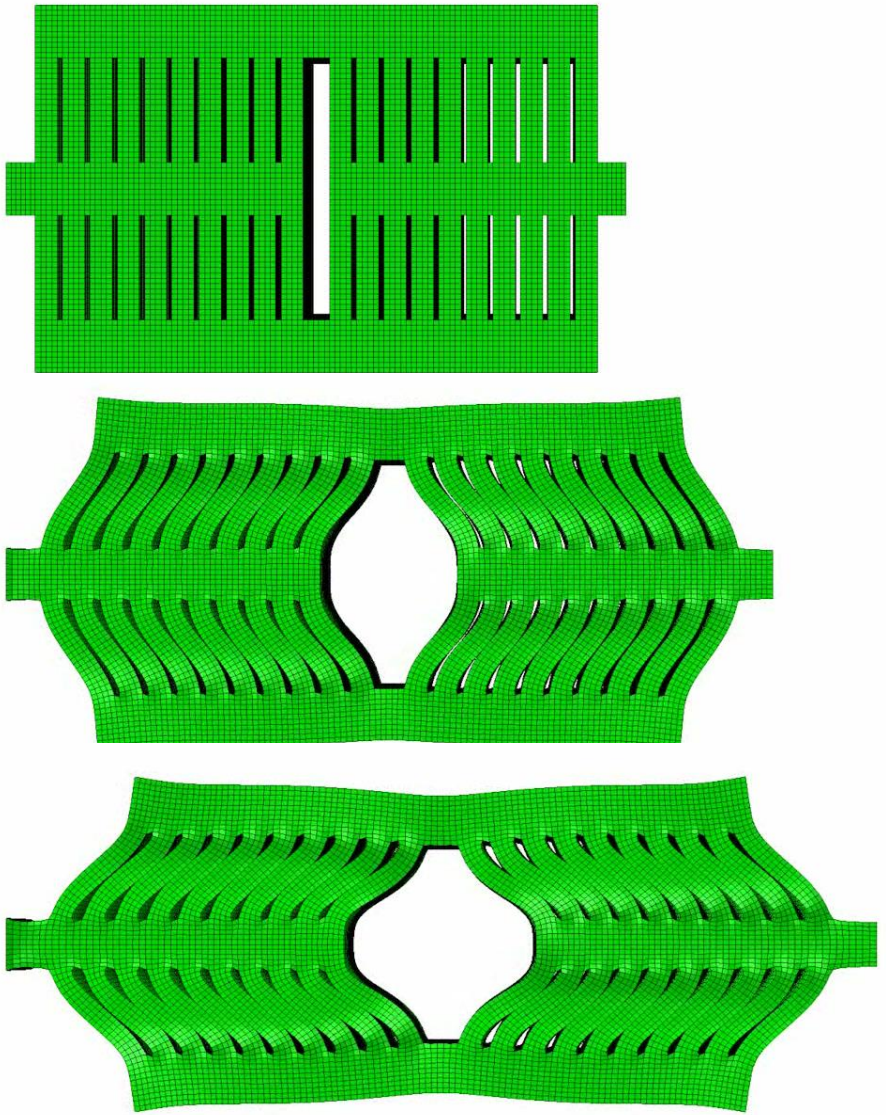




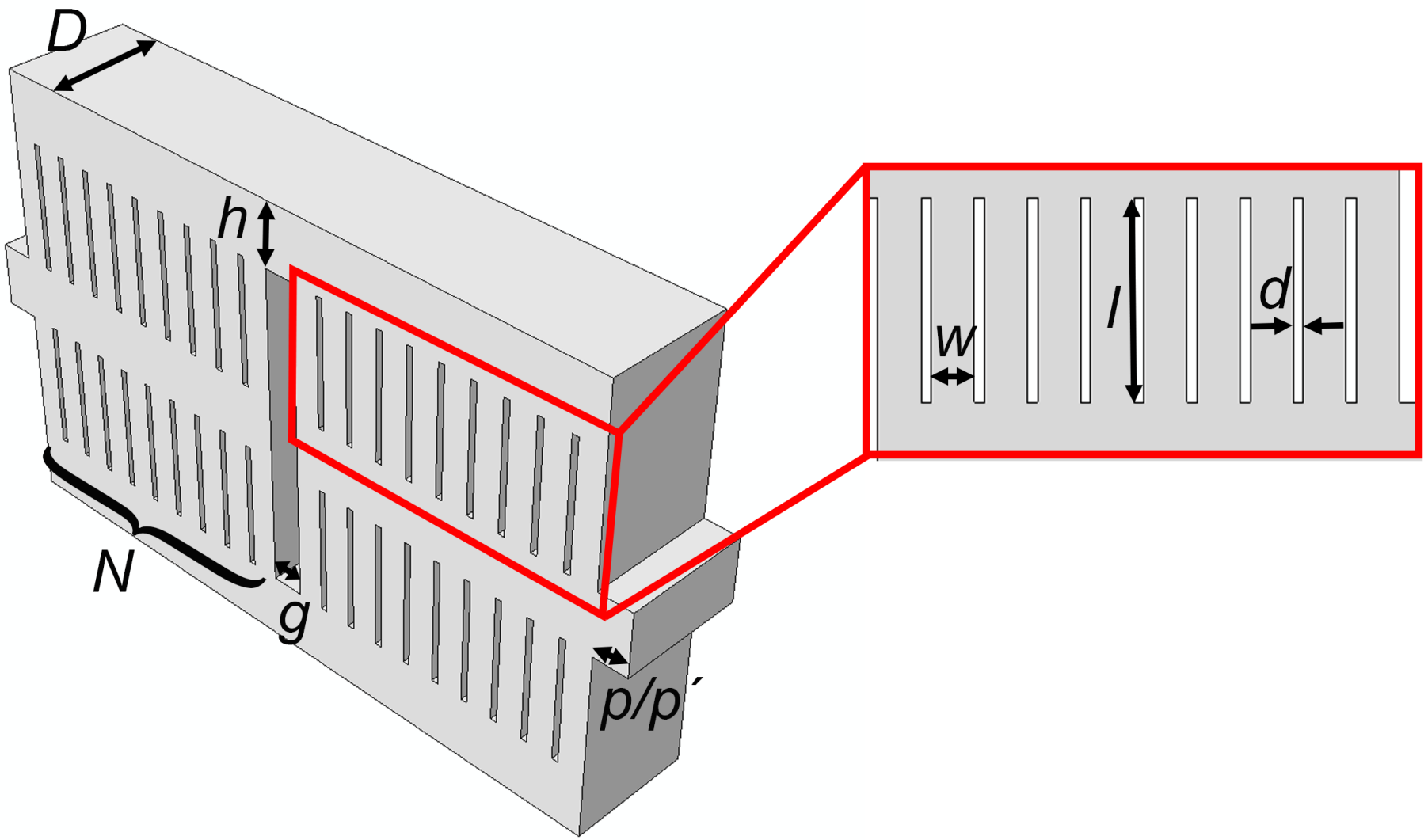
Timmermann, et al. in preparation Patent pending

Strain-stiffening of the structure

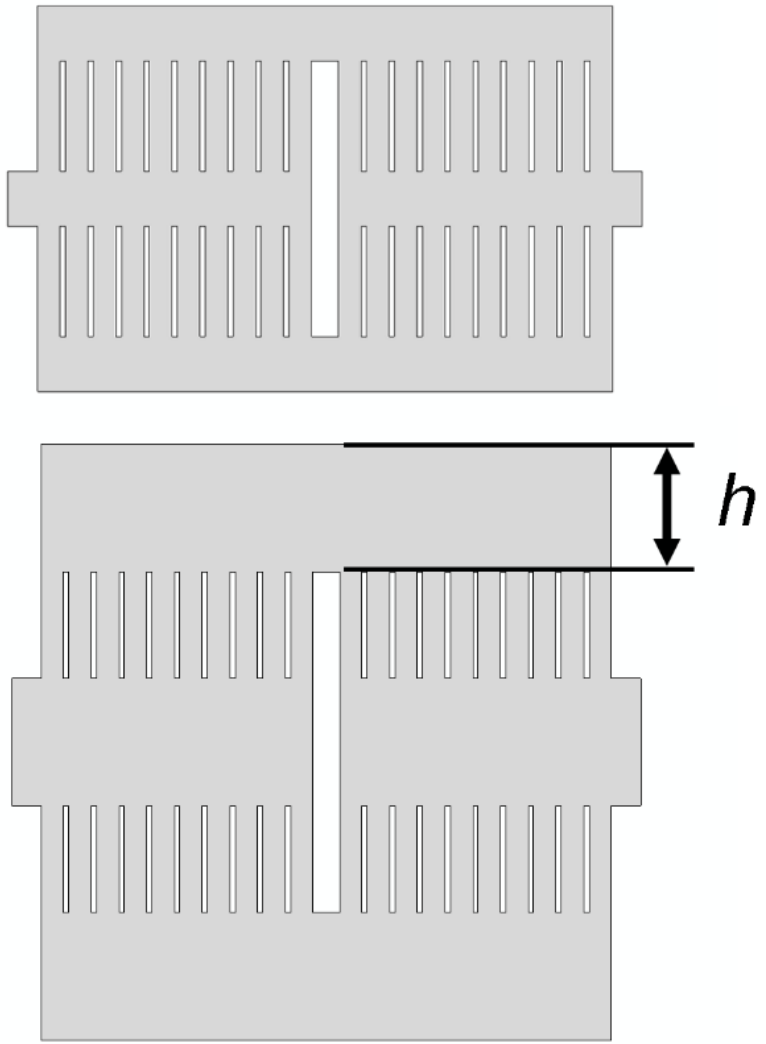


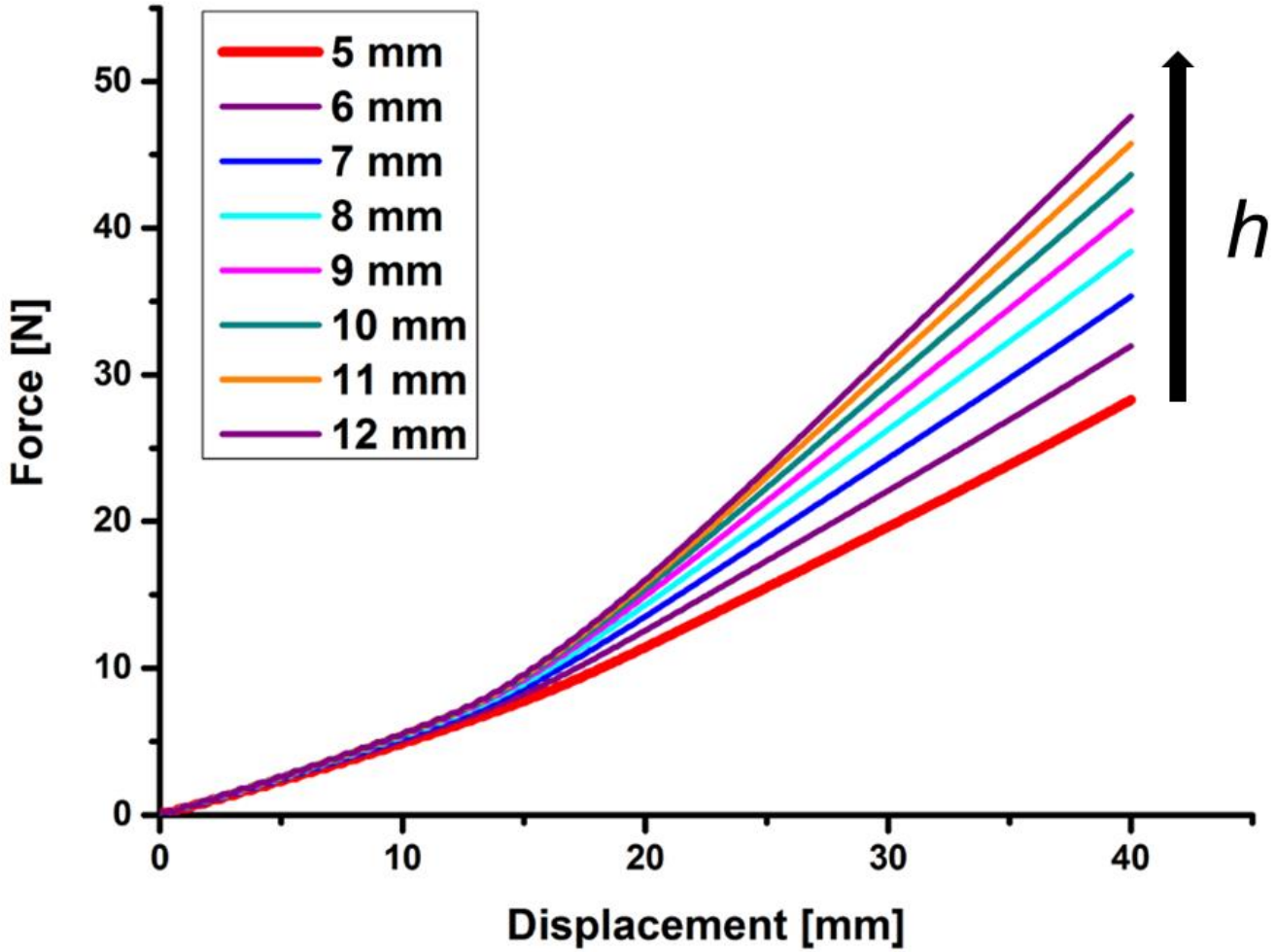


Parameters with influence on the strain-stiffening



Influence of backbone-thickness on strain-stiffening (simulation)





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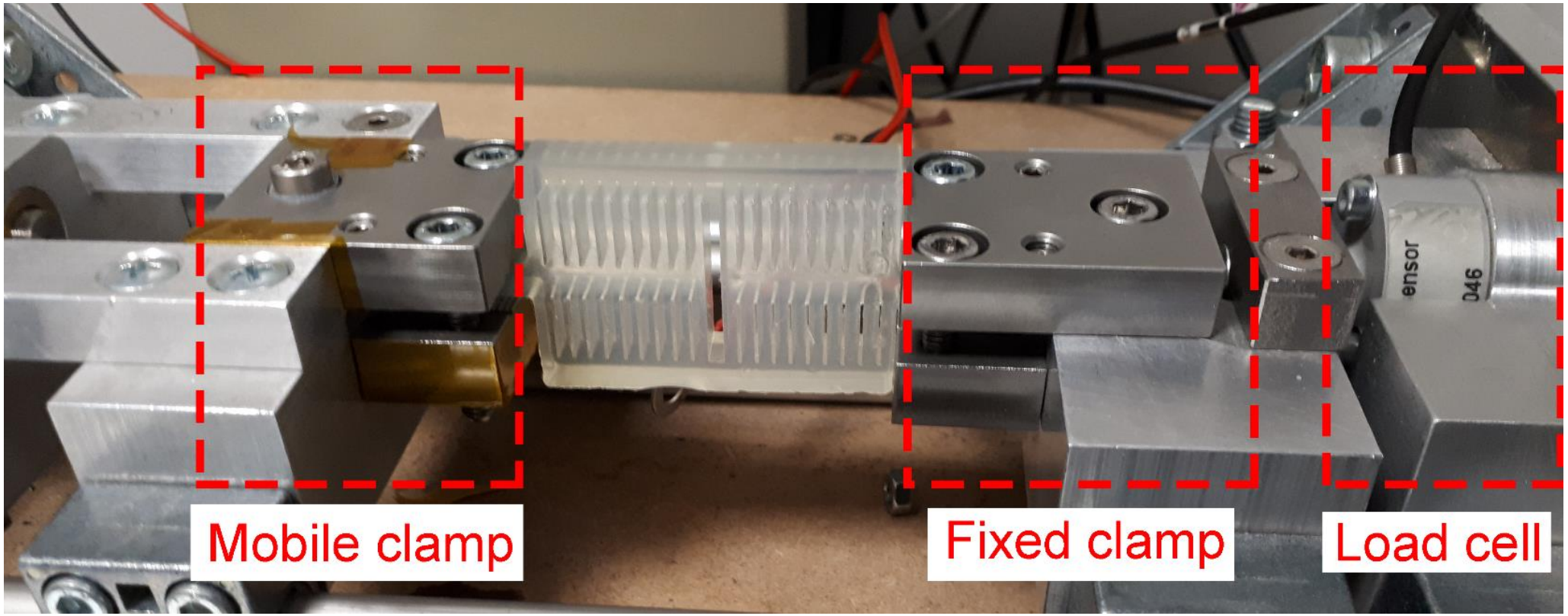
Tensile Tests



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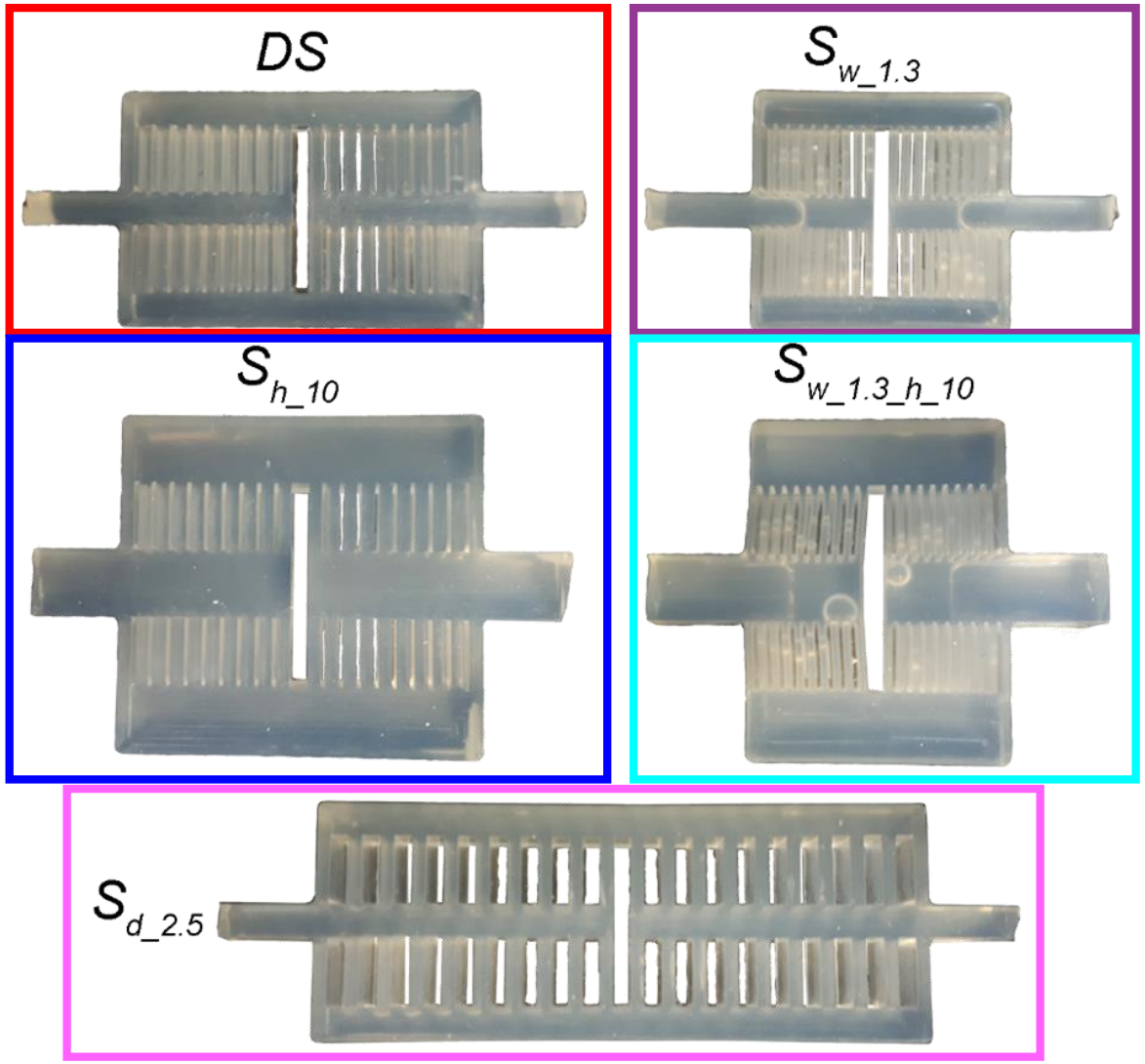
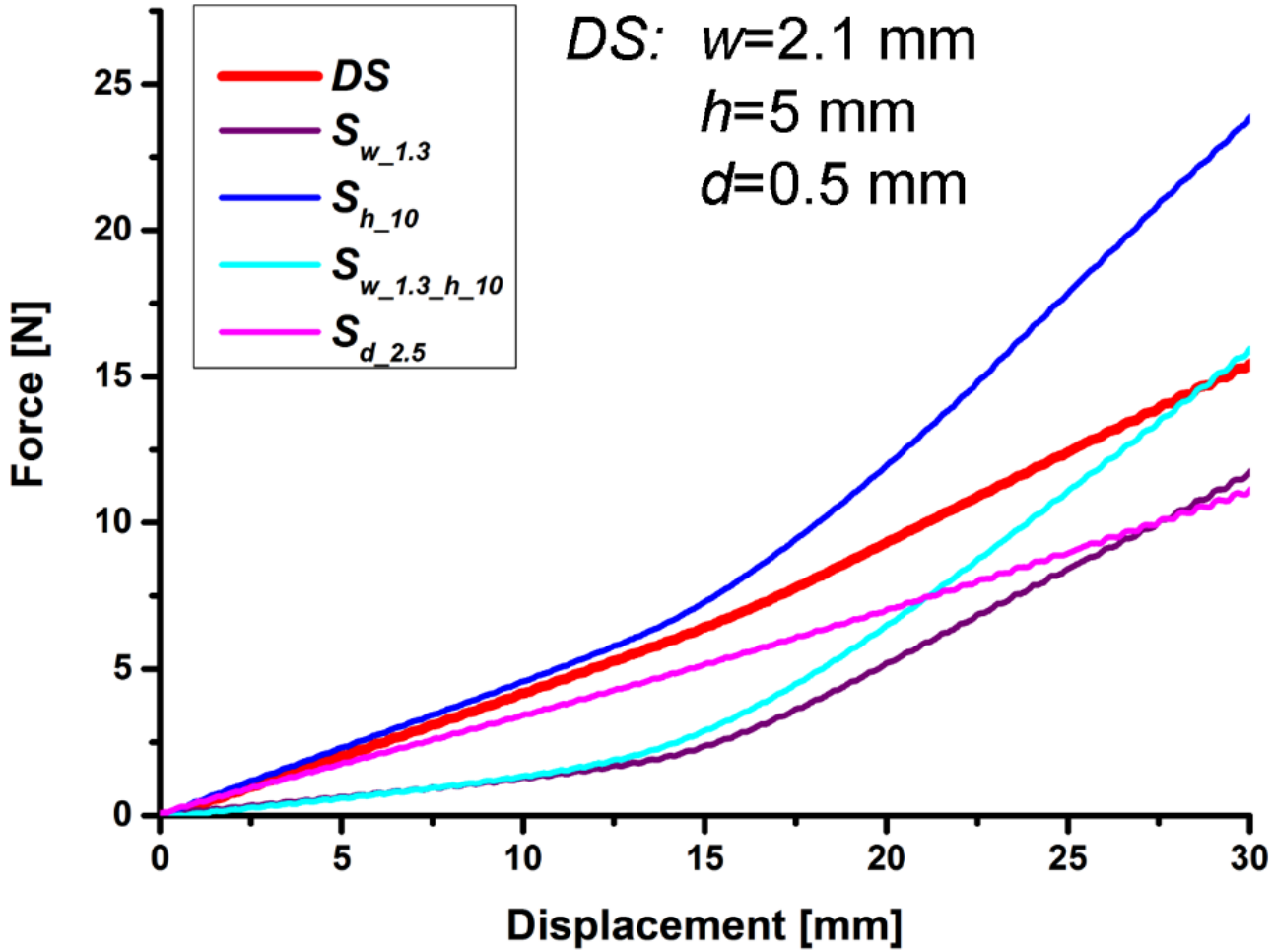
Tensile tests prove results from simulation

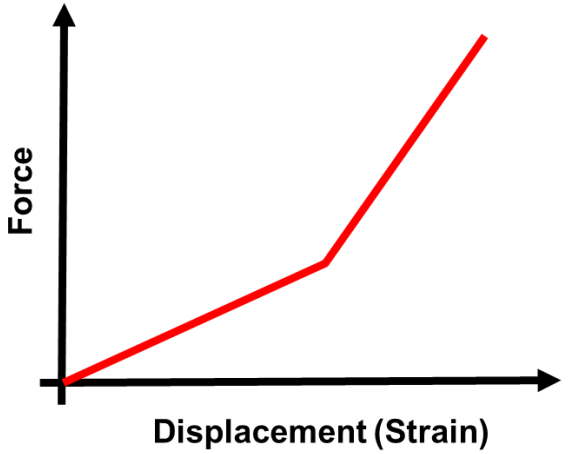




Timmermann, et al. in preparation

A novel Material with:

- Highly non-linear material behavior
- Tunable stiffness upon deformation

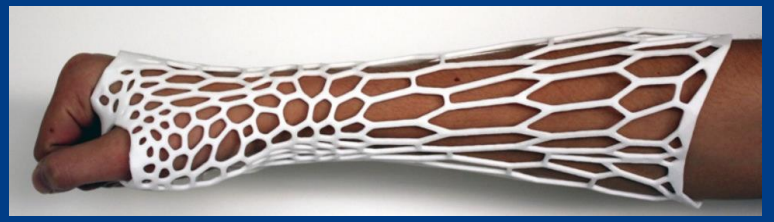


Strain-stiffening is:

- Rate independent
- Material independent
- Independent from chemicals
- Completely reversible

Possible application

Innovative light-weight bone fracture treament



High flexibility at low degree of deformation

High stiffness at high degree of deformation

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