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Design process for 4D printed composite macroscopic bending hygromophs.

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BCI Doctoral Research Symposium 2023

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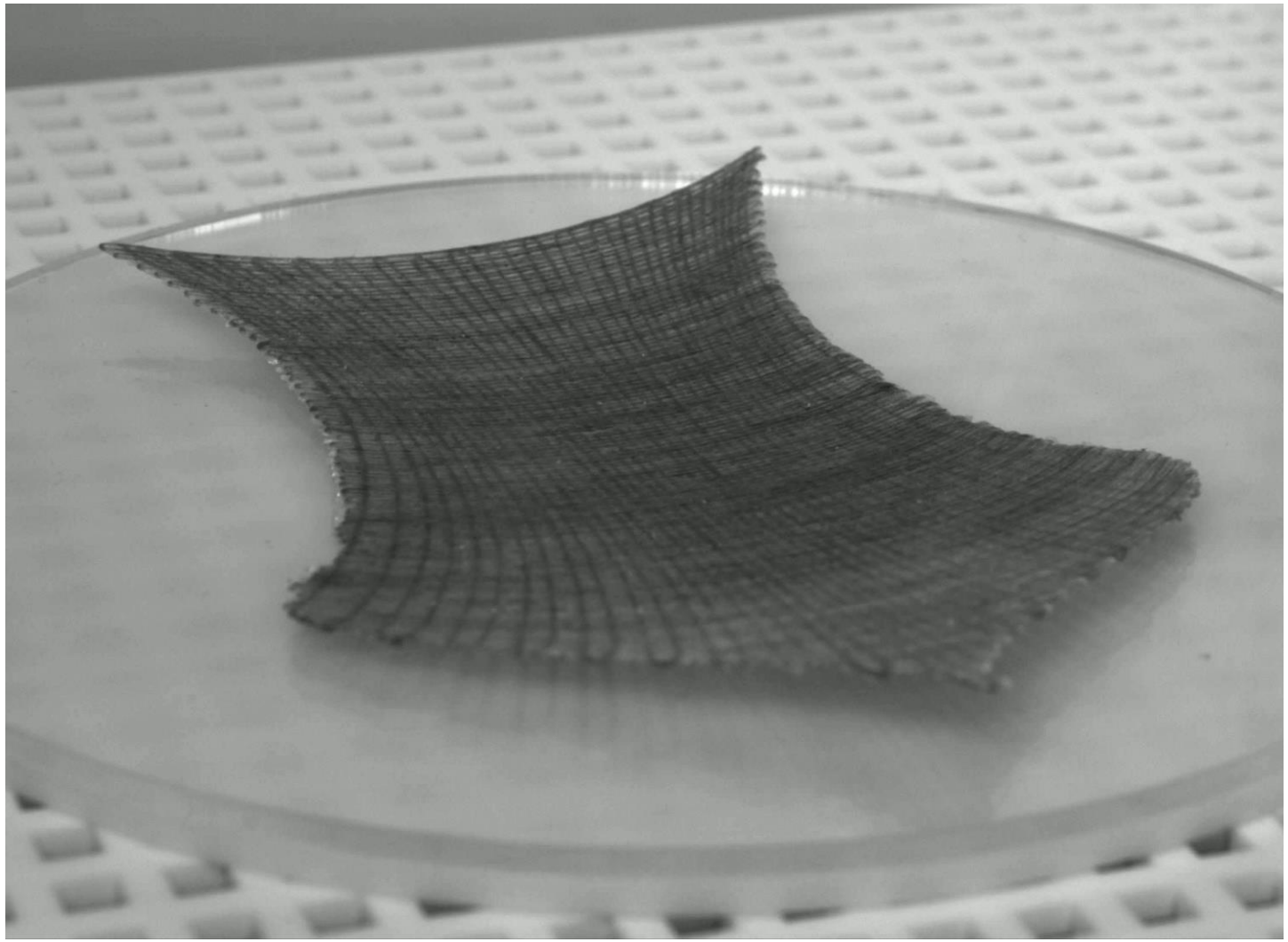
4D printing



de Kergariou, et al.. The design of 4D printed hygromorphs: state-of-the-art and future challenges. Advanced Functional Materials, 33, p2210353, 2023.

4D printing

Measure the porosity:

de Kergariou, C., Le Duigou, A., Popineau, V., Gager, V., Kervoelen, A., Perriman, A., Saidani-Scott, H., Allegri, G., Panzera, T.H. and Scarpa, F., 2021. Measure of porosity in flax fibres reinforced polymer composites. Composites Part A: Applied Science and Manufacturing, 141, p.106183.

BCI Symposium 2021

Influence of humidity on stiffness:

de Kergariou, C., Saidani-Scott, H., Perriman, A., Scarpa, F. and Le Duigou, A., 2022. The influence of the humidity on the mechanical properties of 3D printed continuous flax fibre reinforced polylactic composites. Composites Part A: Applied Science and Manufacturing, 155, p.106805.

BCI Symposium 2022

Definition 4D printing:

de Kergariou, Charles, Demoly, Frédéric, Perriman, Adam, Le Duigou, Antoine, and Scarpa, Fabrizio, 2023. The design of 4D printed hygromorphs: state-of-the-art and future challenges. Advanced Functional Materials, p.2310351.

Today: The return of the flax fibre

Design of 4D printed hygromorphs:

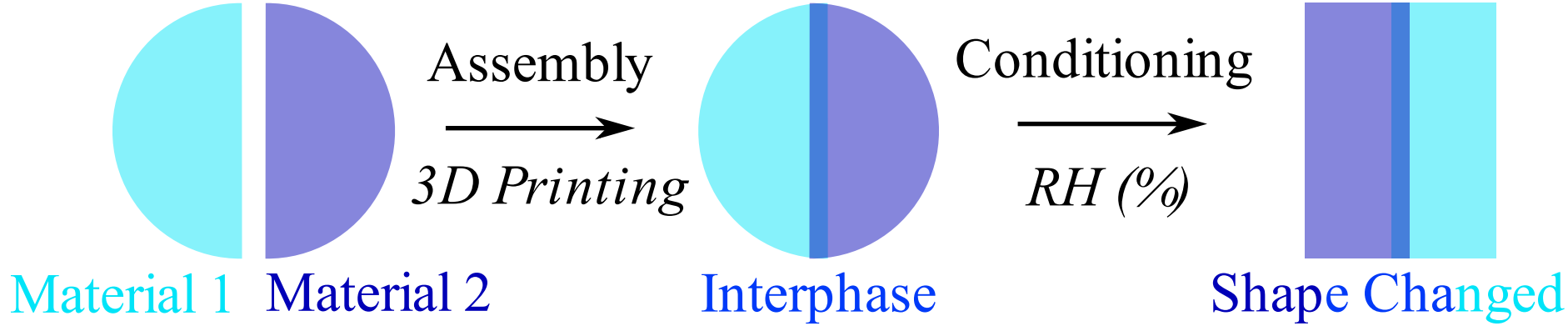
de Kergariou, Charles and Kim, Byung Chul and Perriman, Adam and Le Duigou, Antoine and Guessasma, Sofiane and Scarpa, Fabrizio, 2022. Design of 3D and 4D printed continuous fibre composites via an evolutionary algorithm and voxel-based Finite Elements: Application to natural fibre hygromorphs. Additive Manufacturing, volume 59, 11 p.103144.

Today: The return of the flax fibre

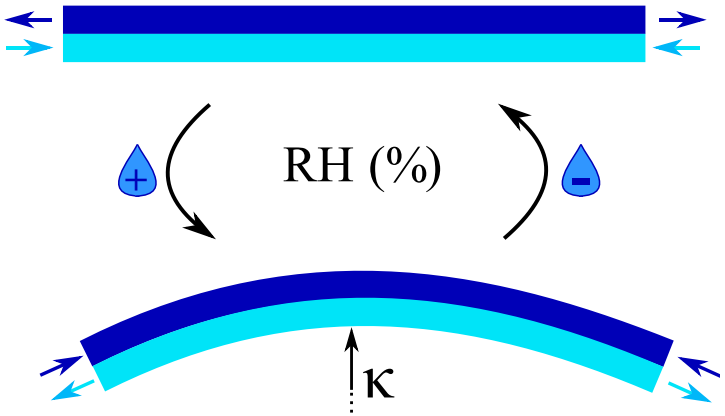
de Kergariou, Charles, Perriman, Adam, Le Duigou, Antoine, and Scarpa, Fabrizio, 2022. Design space and manufacturing of programmable 4D printed continuous flax fibre polylactic acid composite hygromorphs. Materials and Design, volume 225, page 111472.

4D printing

Composite

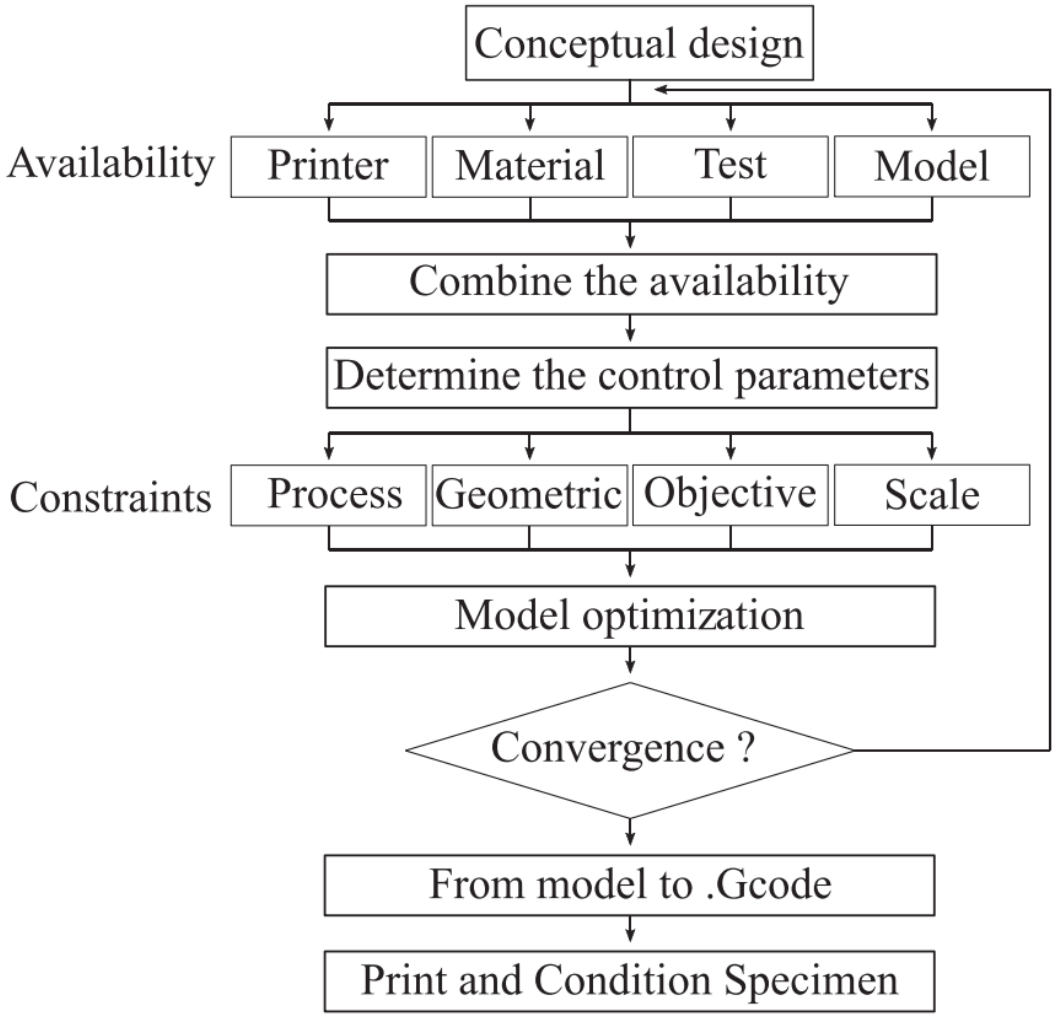


Actuation



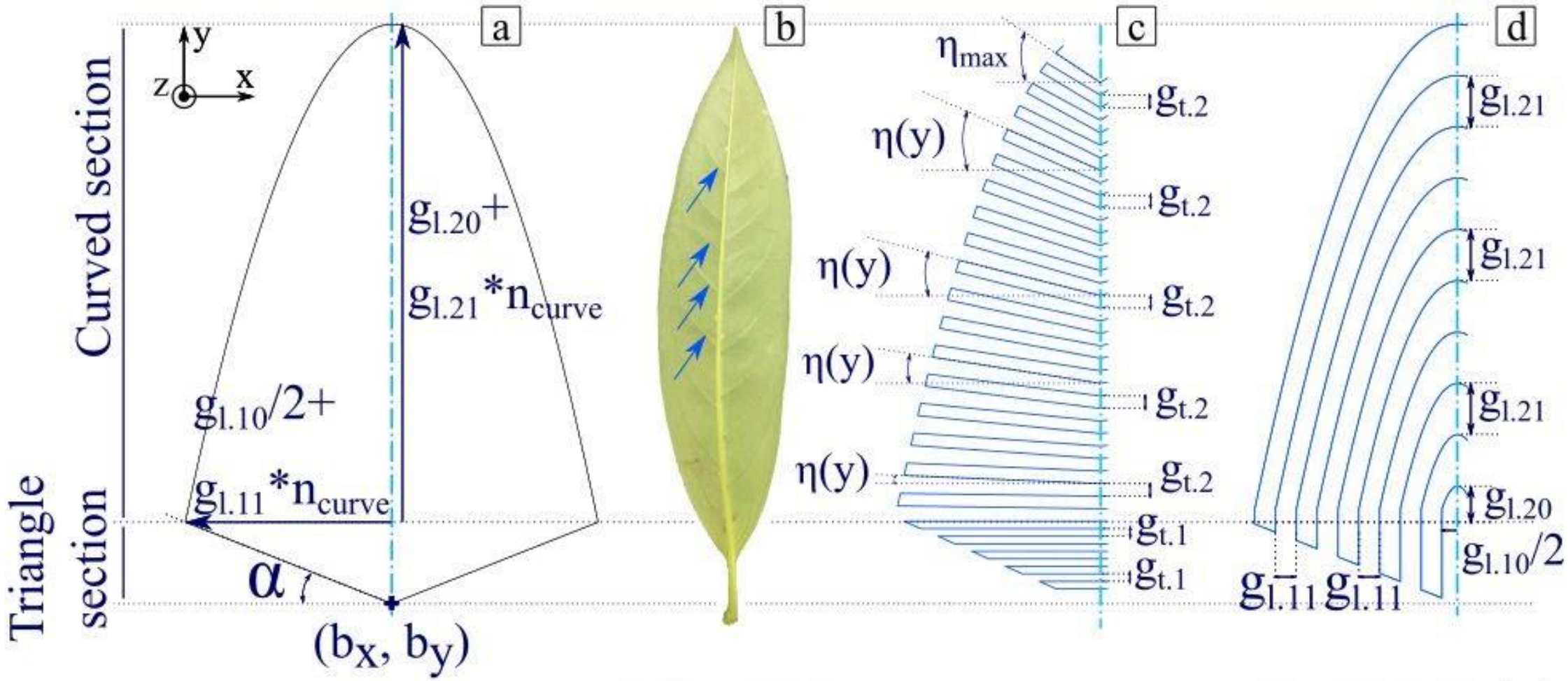
de Kergariou, et al.. The design of 4D printed hygromorphs: state-of-the-art and future challenges. Advanced Functional Materials, 33, p2210353, 2023.

Conclusion



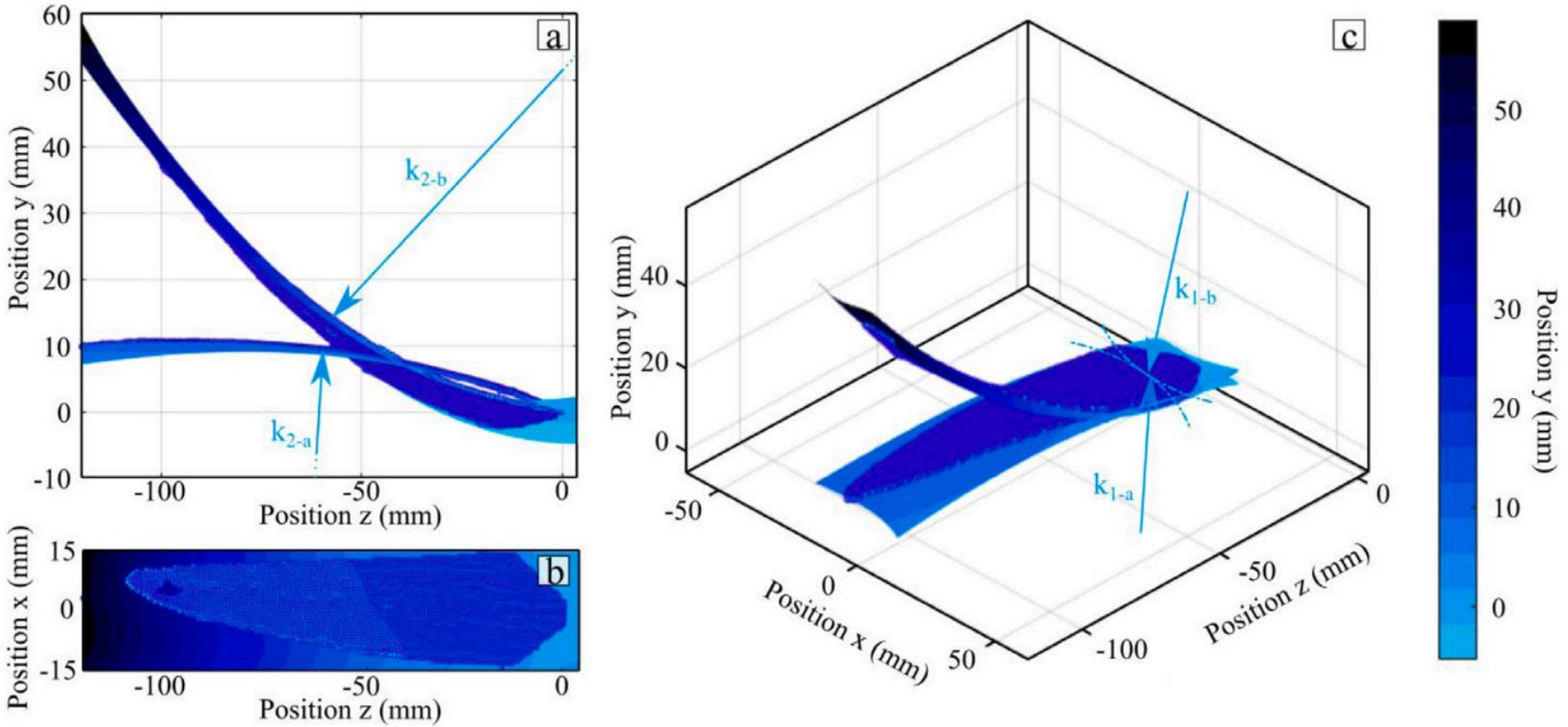
de Kergariou, et al.. The design of 4D printed hygromorphs: state-of-the-art and future challenges. Advanced Functional Materials, 33, p2210353, 2023.

Printed structure



C. de Kergariou, et al. Design of 3D and 4D printed continuous fibre composites via an evolutionary algorithm and voxel-based Finite Elements: Application to natural fibre hygromorphs. Additive Manufacturing, volume 59, 11 p.103144 2022.

FEA vs Experiment

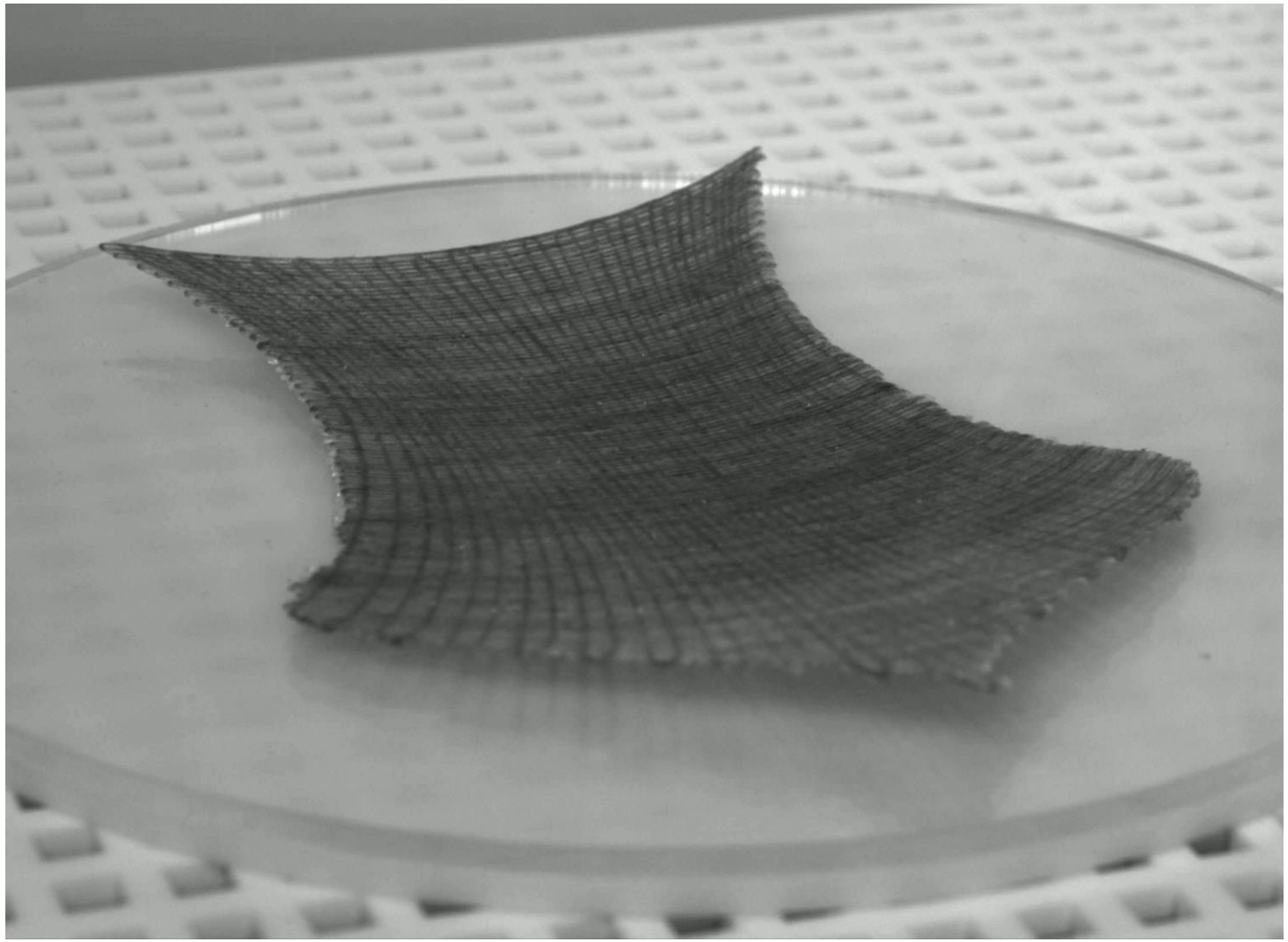


Good qualitative comparison

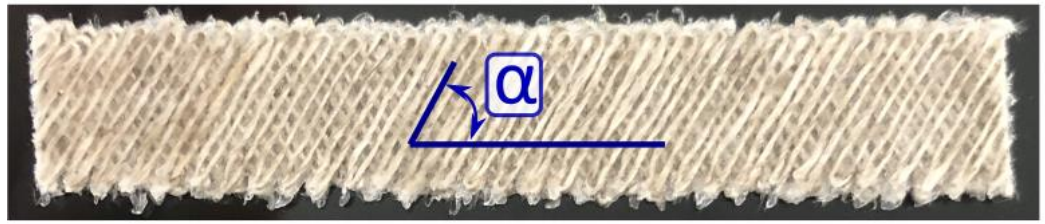
Variable deformation

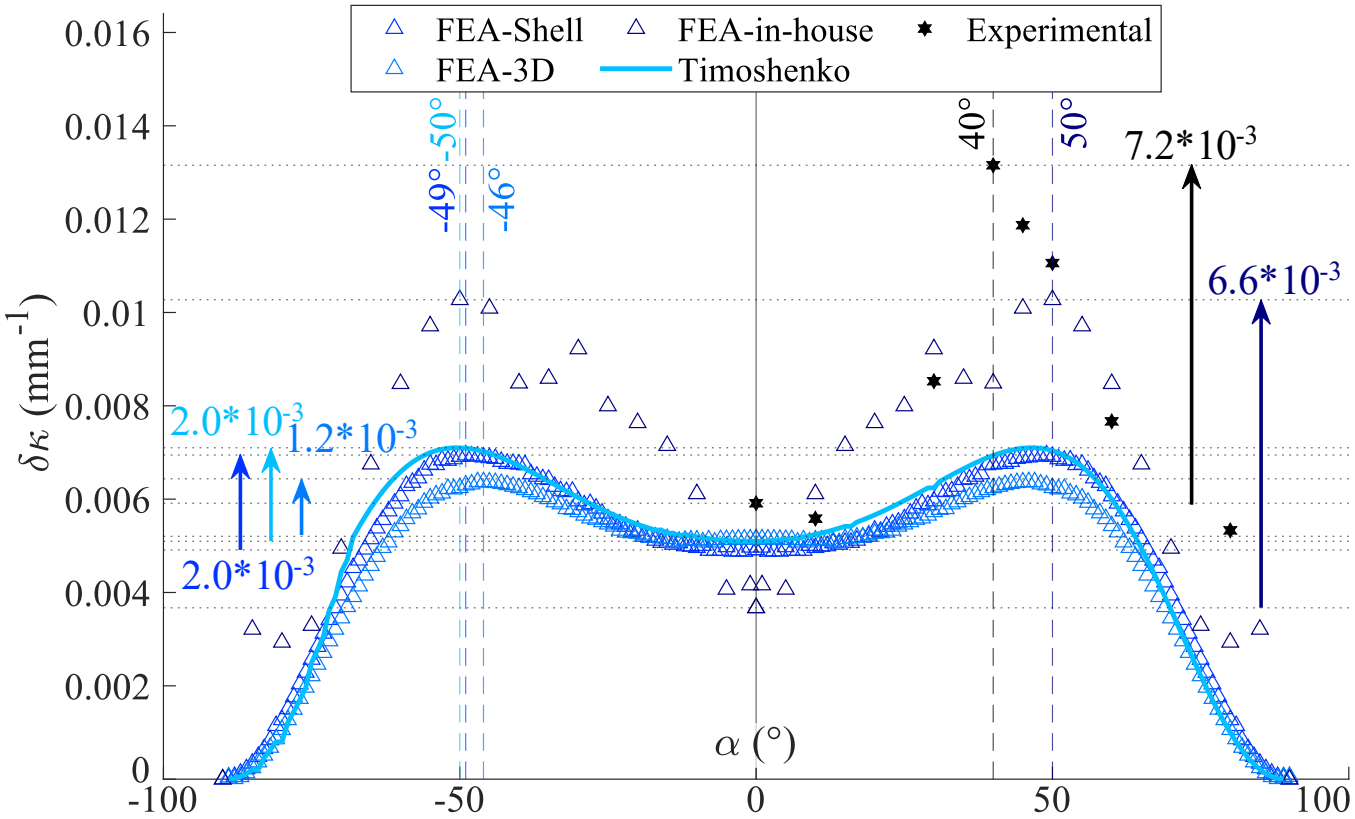
C. de Kergariou, et al. Design of 3D and 4D printed continuous fibre composites via an evolutionary algorithm and voxel-based Finite Elements: Application to natural fibre hygromorphs. Additive Manufacturing, volume 59, 11 p.103144 2022.

4D printing



Angle-HBC





C. de Kergariou, et al. Design space and manufacturing of programmable 4D printed continuous flax fibre polylactic acid composite hygromorphs. Materials & Design, volume 225, p.111472 2023.

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Thank you for the attention

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