Doctoral candidate 6: Model-based region of interest 4DCT of smart materials

Host Institution	Technical University of Denmark
PhD enrolment	Technical University of Denmark
Primary Supervisor	Dr. Rajmund Mokso
Subject area	Tomography, 3D printing, hydrogels, tissues

About this doctoral project and your tasks

Hydrogel based 3D tissue cultures offer new opportunities to model human disease and support the development of novel therapies, given the ability to manufacture and analyse the tissue models reproducibly. X-ray tomography has the potential for providing unique quantitative measurements of the shape of 3D printed hydrogel culture devices and of shape changes induced by the cultured tissues. This will require development of new imaging modalities to provide micron or even sub-micron spatial resolution in water-filled hydrogels and living tissues with only minor spatial electron density contrast. The developed modalities should ideally be applicable in both academic and industrial settings.

You will consider two approaches to increase the contrast: first to enhance the electron density at the interfaces between the studied structures and surrounding water, second to apply the most sensitive phase contrast methods feasible at the laboratory instrumentation. You will in particular cases use synchrotron imaging, mainly as ground truth for the transition to the laboratory X-ray methods. The emphasis of the project will be on being able to image the 3D printed cell culture systems in realistic conditions deploying and optimizing state-of-the-art tomographic and phase reconstruction techniques. This challenging task will require smart design and efficient integration of sample environments.

Your tasks will include :

- Demonstration of the first phase contrast micron and sub-micron resolution 3D images of hydrogel systems for cell culture with laboratory- and synchrotron-based X-ray tomographic scanners.
- Development of an X-ray dose optimised fast imaging concept to characterise static and dynamic shapes of 3D printed hydrogels and cell cultures, and other samples relevant for the consortium, with emphasis on the need for acquisition in aqueous environments.

Foreseen secondments

For this project, we foresee secondments to:

- **Dr. S. Wilson** (3 months) at Sophion Bioscience A/S (Denmark)
- **Prof. dr. J. Sijbers** (2 months) at University of Antwerp (Belgium)

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