Séminaire du laboratoire PIMM

Jeudi 13 juin 2019 à 13h30 en Amphi A

Dr. Jana WILMERS
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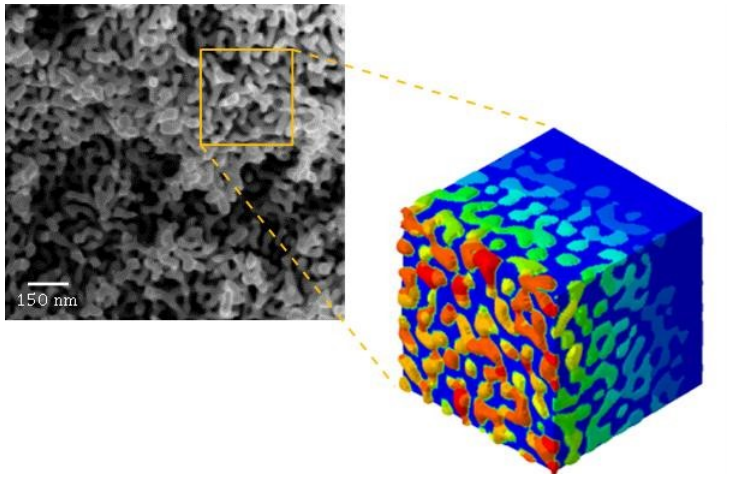
présentera dans le cadre du séminaire ses travaux intitulés :

Functionalisation of Metal-Polymer Nanocomposites: Continuum Modelling of Interface Coupling and Transport-Induced Deformation

Nanoporous metals exhibit a unique microstructure of interconnected nanowire [4,5]. The pore space itself is continuous as well, providing uninterrupted transport paths through the material. By impregnation of the pore space with a ionic conductor, typically a liquid electrolyte, these transport paths and the characteristically high surface to volume ratio facilitate electroactive behaviour. Impregnated with liquid electrolytes, nanoporous metals have been shown to react sensitively to electrical stimuli and to exhibit fully reversible macroscopic deformation. By coating the metal backbone with ionically-activated polymers, increased actuation strains can be achieved while still retaining the metal's superior mechanical properties.



In order to exploit the full potential of these nanocomposite actuators, a detailed understanding of the underlying ion transport mechanisms and means to predict the actuator's response are necessary. Using an interface-extended continuum model [1] that couples large deformations with electrostatics and charge carrier transport for the bulk and the interface, it can be shown that both, the nanocomposite's microstructure and the ions' mobilities, greatly affect the actuator's response. In fact, by modification of the nanocomposite's structure, transport paths, mechanical properties and reaction times can be altered significantly [2,3], thus, providing the means to tailor the actuator behaviour to different applications.

References

[1] J. Wilmers, A.T. McBride, S. Bargmann, Interface Elasticity Effects in Polymer-Filled Nanoporous Metals, JMPS 99, 163-177, 2017.
[2] J. Wilmers, S. Bargmann, Functionalisation of Metal-Polymer-Nanocomposites: Chemoelectromechanical Coupling and Charge Carrier Transport, EML 21, 57-64, 2018
[3] E. Griffiths, J. Wilmers, S. Bargmann, B. Daya Reddy, Nanoporous metal based composites: giving polymers strength and making metals move, *under review*
[4] C. Soyarslan, S. Bargmann, M. Pradas, J. Weissmüller, 3d stochastic bicontinuous microstructures: generation, topology and elasticity, Acta Mater. 149, 326-340, 2018
[5] S. Bargmann et al., Generation of 3D representative volume elements (RVEs) for heterogeneous materials: a review, Prog. Mater. Sci. 96, 322-384, 2018