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MULTI-SCALE CHARACTERISATION AND MODELLING OF ORGANIC AEROGELS

Ameya Rege* **and Mikhail Itskov**

Department of Continuum Mechanics, RWTH Aachen University,
Kackertstr. 9, 52072 Aachen,
E-mail address: rege@km.rwth-aachen.de and URL: www.km.rwth-aachen.de

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The literature on organic aerogels is not very extensive with regards to their mechanical properties. Especially, polysaccharide based aerogels have been attracting much attention in the recent years, given their biocompatibility and bio-degradability. Being potential candidates for many biomedical applications, their mechanical behaviour and structural integrity have become state of the art issues that need thorough investigations.

The mechanical behaviour of cellulose aerogels has recently been analysed and studied under compression [1] and tension [2]. These aerogels are characterised by a cellular morphology, wherein under loading the microcells undergo bending and stretching (or compression). This behaviour is captured using the Euler-Bernoulli beam theory. Under tension, the standard theory suffices as the material sustains only small strains before failure, which is accurately predicted by the model. However under compression, the extended version of the theory [3] is applied and a new strain energy density function is proposed. The model consists of a few physically motivated parameters correlated to the experimental data. Lastly, the model is validated against different experimental data from polysaccharide based aerogels, such as cellulose, pectin and κ-carrageenan aerogels. Furthermore, the proposed approach is then also used to describe the behaviour of certain resorcinol-formaldehyde aerogels [4].

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