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MICROSTRUCTURE-INFORMED MODELING OF OPEN-POROUS CELLULAR MATERIALS

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There have been several computational studies investigating the influence of the relative density on the macroscopic mechanical properties of open-porous cellular materials [1, 2]. However, the influence of the pore-sizes on the bulk properties of the material is still unclear for materials that exhibit a wide range of pore sizes over the length scale. The relevance of the pore structure on the properties of such materials was investigated by proposing a constitutive model and was recently reported [3]. In this work, we investigate computationally the influence of three morphological parameters *viz*., the relative density, the pore-size distribution, and the pore-wall thickness on the mechanical properties of such open-porous materials. The results obtained emphasize that the effects of the pore-sizes, distributions and pore-wall thickness are not negligible although the relative density plays a significant role in dictating their mechanical properties. This is particularly true for materials showing a poly-disperse porous structure. As an example, the computational reconstruction of the three-dimensional (3-d) porous network of cellulose aerogels is described and the macroscopic material properties are validated against the experimental data.

REFERENCES

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