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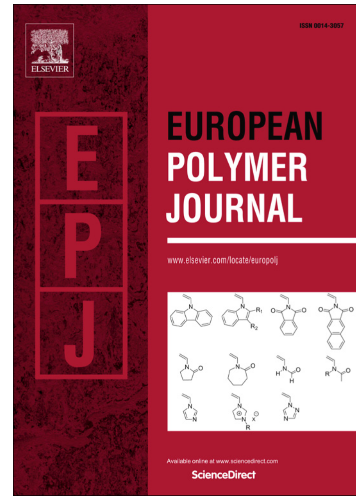

Comprehensive study of biopolymer foam compression up to densification using X-ray micro-tomography and finite element computation

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Comprehensive study of biopolymer foam compression up to densification using X-ray micro-tomography and finite element computation

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Abstract

The aim of this study is to understand the microstructural changes occurring during severe compression of a biopolymeric foam. *In-situ* airy microstructure evolution is monitored as function of loading using X-ray micro-tomography. Cell shrinkage and cell wall thickening are quantified using image analysis. Cell connectivity, morphology and size distributions are related to structural anisotropy generated by loading. Finite element computation is attempted to derive the mechanical model representing the compressive response up to densification. Three models are tested, namely unit cell with elasto-plastic constitutive law, Ogden hyperelasticity and an effective elasto-plastic model. The effective elasto-plastic model is the most realistic model to capture compressive behaviour of the studied foam under all drying situations. Thanks to a densification stiffening term added to account for an evolving cell contact, the effective model shows superior capabilities to capture severe compression of the bio-based foam under all drying conditions.

Keywords

Severe compression; biopolymer foam; X-ray micro-tomography; Finite element computation; drying conditions.