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# Microscopic full-field three-dimensional strain measurement during the mechanical testing of additively manufactured porous biomaterials

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## ABSTRACT

A custom-designed micro-digital image correlation system was used to track the evolution of the full-surface three-dimensional strain field of Ti6Al4V additively manufactured lattice samples under mechanical loading. The high-magnification capabilities of the method allowed to resolve the strain distribution down to the strut level and disclosed a highly heterogeneous mechanical response of the lattice structure with local strain concentrations well above the nominal global strain level. In particular, we quantified that strain heterogeneity appears at a very early stage of the deformation process and increases with load, showing a strain accumulation pattern with a clear correlation to the later onset of the fracture.

The obtained results suggest that the unique opportunities offered by the proposed experimental method, in conjunction with analytical and computational models, could serve to provide novel important information for the rational design of additively manufactured porous biomaterials.

**Keywords:** Digital image correlation, microscopic deformation, additive manufacturing, porous biomaterials, failure.

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