6th European Conference on Computational Mechanics (Solids, Structures and Coupled Problems) (ECCM 6)
7th European Conference on Computational Fluid Dynamics (ECFD 7)
June 11- 15, 2018, Glasgow, UK

CELLULAR MATERIALS WITH GIANT POSITIVE AND NEGATIVE THERMAL EXPANSION

HANXING ZHU

School of Engineering, Cardiff University
Cardiff CF24 3AA, UK
E-mail: zhuh3@cf.ac.uk
https://www.cardiff.ac.uk/people/view/364504-zhu-han-xing

Key words: *Thermal Expansion, 2D Cellular Materials, 3D Cellular Materials, Structural Hierarchy.*

ABSTRACT

When temperature increases, the volume of an object changes. This property was quantified as the coefficient of thermal expansion only a few hundred years ago. Part of the reason is that the change of volume due to the variation of temperature is in general extremely small and imperceptible. Here we report abnormal giant linear thermal expansions in different types of two-ingredient micro-structured hierarchical and self-similar cellular materials [1]. The cellular materials can be two-dimensional or three-dimensional, and isotropic or anisotropic, with a positive or negative thermal expansion due to the convex or/and concave shape in their representative volume elements respectively. The magnitude of the thermal expansion coefficient could be five orders larger than that of most natural materials, and about one order larger than the highest value reported in the literature [2]. This study suggests an innovative approach to develop temperature-sensitive functional materials and devices.

REFERENCES

[1] H.X. Zhu, T.X. Fan, Q. Peng and D. Zhang, Giant thermal expansion in 2D and 3D cellular materials, *Advanced Materials*, Vol. **30**, pp. , 2018. Doi: 10.1002/adma.201705048.

[2] R. Lakes, Cellular solids with tunable positive or negative thermal expansion of unbounded magnitude, *Appli. Phys. Lett*. Vol. **90**, 221905, 2007.