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Micro-architected Composite Lattices with Tunable Negative Thermal Expansions QIMING WANG, University of Southern California — Solid materials with minimum or negative thermal expansion (NTE) have broad applications, from dental fillings to thermal-sensitive precision instruments. Previous studies on NTE structures were mostly focused on theoretically design and 2D experimental demonstrations. Here, aided with multimaterial projection microstereolithography, we experimentally fabricate multi-material composite lattices that exhibit significant negative thermal expansion in three directions and over a large range of temperature variations. The negative thermal expansion is induced by the structural interaction of material components with distinct thermal expansion coefficients. The NTE performance can be tuned over a large range by varying the thermal expansion coefficient difference between constituent beams and geometrical arrangement. Our experimental results match qualitatively with a simple scaling law and quantitatively consistently with computational models.

Qiming Wang
University of Southern California

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