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Multifunctional Lattices with Low Thermal Expansion and Low Thermal Conductivity HANG XU, LU LIU, DAMIANO PASINI[1], Mechanical Engineering, McGill University — Systems in space are vulnerable to large temperature changes when travelling into and out of the Earth's shadow. Variations in temperature can lead to undesired geometric changes in susceptible applications requiring very fine precision. In addition, temperature-sensitive electronic equipment hosted in a satellite needs adequate thermal-control to guarantee a moderate ambient temperature. To address these specifications, materials with low coefficient of thermal expansion (CTE) and low coefficient of thermal conductivity (CTC) over a wide range of temperatures are often sought, especially for bearing components in satellites. Besides low CTE and low CTC, these materials should also provide desirable stiffness, strength and extraordinarily low mass. This work presents ultralightweight bi-material lattices with tunable CTE and CTC, besides high stiffness and strength. We show that the compensation of the thermal expansion and joint rotation at the lattice joints can be used as an effective strategy to tailor thermomechanical performance. Proof-of-concept lattices are fabricated from Al and Ti alloy sheets via a simple snap-fit technique and vacuum brazing, and their CTE and CTC are assessed via a combination of experiments and theory.

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