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Unusual compressibility in the negative-thermal-expansion material ZrW_2O_8[1] ALBERT MIGLIORI, C. PANTEA, H. LEDBETTER, Y. ZHAO, T. KIMURA, LANL, PETER B. LITTLEWOOD, Cavendish Lab., Univ. of Cambridge, J. VAN DUIJN, Dept. of Physics and Astronomy, Johns Hopkins Univ., G.R. KOWACH, Dept. of Chemistry, The City College of NY — The negative thermal expansion (NTE) compound ZrW_2O_8 has been well-studied because it remains cubic with a nearly constant, isotropic NTE coefficient over a broad temperature range. However, its elastic constants seem just as strange as its volume because NTE makes temperature acts as *positive* pressure, decreasing volume on warming and, unlike most materials, the thermally-compressed solid *softens*. Does ZrW_2O_8 also soften when pressure alone is applied? Using pulse-echo ultrasound in a hydrostatic SiC anvil cell, we determine the elastic tensor of monocrystalline ZrW_2O_8 near 300 K as a function of pressure. We indeed find an unusual decrease in bulk modulus with pressure. Our results are inconsistent with conventional lattice dynamics, but do show that the thermodynamically-complete constrained-lattice model can relate NTE to elastic softening as increases in either temperature or pressure reduce volume, establishing the predictive power of the model, and making it an important concept in condensed-matter physics.

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