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Negative coefficient of thermal expansion in (epoxy resin)/(zirconium tungstate) nanocomposites ERICH SEE, Virginia Tech Department of Physics, MC 0435, 910 Drillfield Drive, Blacksburg, VA 24061 , VLADIMIR KOCHERGIN, LAUREN NEELY, MADRAKHIM ZAYETNIKOV, MicroXact, Inc. 2000 Kraft Drive, Suite 1207. Blacksburg, VA 24060, GIANLUIGI CIOVATI, Jefferson Lab, 12000 Jefferson Avenue, MS 58, Suite 17, Newport News, VA 23606, HANS ROBINSON, Virginia Tech Department of Physics, MC 0435, 910 Drillfield Drive, Blacksburg, VA 24061 — The α-phase of zirconium tungstate (ZrW_2O_8) has the remarkable property that its coefficient of thermal expansion (CTE) takes on a nearly constant negative value throughout its entire range of thermal stability (0 – 1050 K). Composites of ZrW_2O_8 nanoparticles and polymer resins have a reduced CTE compared to the pure polymer, but previous work has been restricted to measurements near room temperature. We show that the CTE of such composites can take on increasingly negative values as the temperature is lowered to cryogenic values. We used this phenomenon to fabricate a metal-free all-optical cryogenic temperature sensor by coating a fiber optic Bragg grating with the nanocomposite. This sensor has a sensitivity at 2 K that is at least six time better than any previous fiber-optic temperature sensor at this temperature.

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