

Abstract Submitted
for the MAR12 Meeting of
The American Physical Society

Zirconium tungstate/epoxy resin nanocomposites with negative coefficient of thermal expansion for all-dielectric cryogenic temperature sensors ERICH SEE, Virginia Tech, VLADIMIR KOCHERGIN, LAUREN NEELY, MADRAKHIM ZAYETNIKOV, MicroXact Inc., GIANLUIGI CIOVATI, Jefferson Lab, HANS ROBINSON, Virginia Tech — The α -phase of zirconium tungstate (ZrW_2O_8) has the remarkable property that its coefficient of thermal expansion (CTE) is negative over its entire range of thermal stability (0-1050K), and through this range it has a nearly constant negative CTE. When ZrW_2O_8 nanoparticles are mixed into a polymer resin, the resulting composite has a reduced CTE when compared with that of the pure polymer. However, previous research on such composites has occurred only near room temperature. We show that at cryogenic temperatures, it is possible to make ZrW_2O_8 /resin nanocomposites with negative CTE. By coating a fiber-optic Bragg grating with such a composite, we were able to create an all-optical temperature sensor without the use of metals, which would be of particular use in superconducting RF cavities. The sensor has sensitivity down to at least 2 K, six times lower than previous fiber-optic temperature sensors.

Erich See
Virginia Tech

Date submitted: 11 Nov 2011

Electronic form version 1.4