

Thermo-piezotronic Effects in a Composite Fiber of Piezoelectric Dielectrics and Nonpiezoelectric Semiconductors

Ruoran Cheng^{*}, Chunli Zhang^{*}, Weiqiu Chen^{*}, Jiashi Yang[#]

^{*} Department of Engineering Mechanics, Zhejiang University, Hangzhou, 310027, China
(crr_nolan@zju.edu.cn, zclwei@zju.edu.cn, chenwq@zju.edu.cn)

[#] Department of mechanical and Materials Engineering, University of Nebraska-Lincoln,
Lincoln, NE 68588-0526, U.S.A (jyang1@unl.edu)

Abstract

We study the effect of a uniform temperature change on the extensional deformation of a composite fiber of piezoelectric dielectrics and nonpiezoelectric semiconductors. A one-dimensional model is constructed. Through a theoretical analysis, it is shown that under a temperature change the mobile charges in the semiconductor redistribute under the electric field produced through thermoelastic, pyroelectric and piezoelectric effects. This thermally induced redistribution or motion of charge carriers may be called a thermo-piezotronic effect. It suggests the possibility of sensing or transduction between a temperature change and electric currents. This effect can be applied to design some novel piezotronic devices regulating via temperature.