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Piezoelectric Coupling in Non-piezoelectric Materials due to Nonlocal Size Effects at the Nanoscale: Fundamental Solutions, Embedded Inclusions and Piezoelectric Composites without Electromechanical Constituents PRADEEP SHARMA, University of Houston — In a piezoelectric material an applied *uniform* strain can induce an electric polarization (or vice-versa). Crystallographic considerations restrict this technologically important property to non-centrosymmetric systems. It has been shown both mathematically and physically, that a *non-uniform strain* can potentially break the inversion symmetry and induce polarization in non-piezoelectric materials. The coupling between strain gradients and polarization; and strain and polarization gradients, is investigated in this work. Based on a field theoretic framework accounting for this phenomena, we (i) develop the fundamental solutions (Green's functions) for the governing equations (ii) solve the general embedded inclusion problem with explicit results for the spherical and cylindrical inclusion shape and, (iii) Illustrate using the simple example of a bilaminate how an apparently piezoelectric composite may be created without using constituent piezoelectric materials.

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