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Thermal-Induced Fracture of Electroded Piezoelectric Composites

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This paper deals with a generalized two-dimensional problem of an interface crack in a piezoelectric bi-material system, which consists of a soft internal electrode layer and two dissimilar piezoelectric semi-bodies located at the upper and lower two sides of the electrode layer. The crack is located between the electrode layer and the upper semi-body, and the two semi-bodies are assumed to be only subject to uniform heat flux at infinity. Based on the Stroh formalism for mixed boundary conditions of thermo-piezoelectric materials, the problem is at first reduced to an interfacial crack problem equivalent to that in purely elastic media, and then the explicit expressions are presented for the complex potentials. Finally, the structure of singular fields ahead of the interface is discussed. It is shown that the singular fields near the electrode-matrix interfacial crack are the same as those in a purely elastic bi-material system with interface cracks, that is, the crack-tip singularities of electrode-matrix interface cracks can uniquely be characterized by an inverse square root singularity and a pair of oscillatory singularities.

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