SM9S_12249

XXI International Congress of Theoretical and Applied Mechanics
Warsaw, Poland, August 15–21, 2004

Contact Zone Approach to the Analysis of Interface Cracks in Thermomechanically Loaded Piezoelectric Bimaterials

Klaus P. Herrmann[(1)], **Volodymyr V. Loboda**[(2)]

(1) *Department of Mechanical Engineering, Paderborn University, Paderborn, Germany*
(2) *Department of Theoretical and Applied Mechanics, National University, Dniepropetrovsk, Ukraine*

A piezoelectric bimaterial composed of two bounded semi-infinite spaces having a tunnel interface crack with a mechanically frictionless contact zone under the action of a remote mixed mode mechanical loading as well as of thermal and electrical fluxes is considered. Assuming that all electromechanical fields are independent on the coordinate co-directed with the crack front the matrix-vector representations of thermal, mechanical and electrical characteristics via a sectionally-holomorphic vector-function are formulated. Due to these representations the combined Dirichlet-Riemann and Riemann problems of linear relationship are formulated both for electrically permeable and electrically insulated models of the open part of the crack. These problems are solved exactly and close analytical expressions for all electromechanical components at the interface as well as the transcendental equations and analytical formulas for the determination of the contact zone length and the associated fracture mechanical parameters are derived. The influence of the mechanical loading as well as of the thermal and electrical fluxes upon the mentioned values is studied and a comparison of the results obtained in the framework of the electrically permeable and electrically insulated crack models has been performed. It is particularly demonstrated that the contact zone length is rather small in comparison to the crack length for a pure tensile load, however it can substantially increase in the presence of a shear load as well as of thermal or electrical fluxes. Moreover, the increase of the electrical flux can lead to an essential difference of the results obtained by means of the electrically permeable and electrically insulated models of the crack, respectively.

View the extended summary