Preface

Piezoelectric materials are widely used in sensors, actuators and other modern technologies. However, they are very brittle and predisposed to fracture. Appearance of cracks and interfacial failure leads to an undesired degradation of electrical and mechanical performance. This monograph is devoted to a comprehensive study of cracks situated at the interface of two piezoelectric materials. Plane electromechanical problems for piezoceramic bodies with interface cracks are analyzed. Solution methods are developed. Different electric boundary conditions along the crack faces are discussed. The cases of electrically permeable, impermeable, partially permeable and conducting cracks are considered. The oscillating and contact zone models for in-plane straight interface cracks between two dissimilar piezoelectric materials are used, although the attention is mainly paid to the contact zone model. The model of a crack with electromechanical pre-fracture zones is also studied. The developed analytical methods permit, in many cases, to attain exact solutions. Formulations for different crack models are reduced to the problems of linear relationship and solved analytically. Expressions for the stress and electric displacement intensity factors and also for the energy release rate are obtained and presented in explicit form. A new technique for the determination of electromechanical fields at the tips of interface cracks in finite-sized piezoceramic bodies of arbitrary shape under different load types is elaborated. The influence of the electric permittivity of the crack, the mechanical load and the electric field upon the electro-elastic state and the main fracture mechanical parameters are analyzed and clearly illustrated. Many peculiarities concerning the behavior of piezoelectric bimaterial with interface cracks are found. Conclusions and recommendations which can be important for engineering practice are made.

This monograph addresses academics and engineers working on piezoelectric materials and components, especially those who are active in the analysis of strength and durability of piezoelectric constructions. Also, this book is useful for postgraduate students and researchers dealing with the fracture mechanics of piezoelectric materials and teaching at the departments of mechanical engineering, civil engineering, material science, electrical engineering and computational engineering.

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