



**IUTAM Symposium on Multiscale Modelling of  
Fatigue, Damage and Fracture in Smart Materials:  
Proceedings of the IUTAM Symposium on  
Multiscale Modelling ... September 1-4, 2009: 24  
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Today, multi-functional materials such as piezoelectric/ferroelectric ceramics, magneto-strictive and shape memory alloys are gaining increasing applications as sensors, actuators or smart composite materials systems for emerging high tech areas. The stable performance and reliability of these smart components under complex service loads is of paramount practical importance. However, most multi-functional materials suffer from various mechanical and/or electro-magnetical degradation mechanisms as fatigue, damage and fracture. Therefore, this exciting topic has become a challenge to intensive international research, provoking the interdisciplinary approach between solid mechanics, materials science and physics. This book summarizes the outcome of the above mentioned IUTAM-symposium, assembling contributions by leading scientists in this area.

Particularly, the following topics have been addressed: (1) Development of computational methods for coupled electromechanical field analysis, especially extended, adaptive and multi-level finite elements. (2) Constitutive modeling of non-linear smart material behavior with coupled electric, magnetic, thermal and mechanical fields, primarily based on micro-mechanical models. (3) Investigations of fracture and fatigue in piezoelectric and ferroelectric ceramics by means of process zone modeling, phase field simulation and configurational mechanics. (4) Reliability and durability of sensors and actuators under in service loading by alternating mechanical, electrical and thermal fields. (5) Experimental methods to measure fracture strength and to investigate fatigue crack growth in ferroelectric materials under electromechanical loading. (6) New ferroelectric materials, compounds and composites with enhanced strain capabilities.

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