FRACTURE OF NANO AND ENGINEERING MATERIALS AND STRUCTURES
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Fracture and Delamination of Oxide: Fracture and delamination of 1μm (1x10^{-6} m) SiO₂ on Si with 1μm conical probe tip. Courtesy of Hysitron Inc., Minneapolis, Minnesota, USA

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Editor’s Preface

This volume contains two-page abstracts of the 698 papers presented at the “16th European Conference of Fracture,” (ECF16) held in Alexandroupolis, Greece, July 3-7, 2006. The accompanying CD attached at the back cover of the book contains the full length papers.

The abstracts of the fifteen plenary lectures are included in the beginning of the book. The remaining 683 abstracts are arranged in 25 tracks and 35 special symposia/sessions with 303 and 380 abstracts, respectively. The papers of the tracks have been contributed from open call, while the papers of the symposia/sessions have been solicited by the respective organizers. Both tracks and symposia/sessions fall into two categories, namely, fracture of nanomaterials and structures and engineering materials and structures with 88 and 595 papers, respectively.

Started in 1976, the European Conference of Fracture (ECF) takes place every two years in a European country. Its scope is to promote world-wide cooperation among scientists and engineers concerned with fracture and fatigue of solids. ECF16 was under the auspices of the European Structural Integrity Society (ESIS) and was sponsored by the American Society of Testing and Materials, the British Society for Stain Measurement, the Society of Experimental Mechanics, the Italian Society for Experimental Mechanics, and the Japanese Society of Mechanical Engineers. ECF16 focused in all aspects of structural integrity with the objective of improving the safety and performance of engineering structures, components, systems and their associated materials. Emphasis was given to the failure of nanostructured materials and nanostructures and micro and nanoelectromechanical systems (MEMS and NEMS). The technical program of ECF16 was the product of hard work and devotion of more than 150 world leading experts to whom I am greatly indebted. The success of ECF16 relied solely on the dedication and titanic work of the members of the Scientific Advisory Board, the pillars of ECF16. As chairman of ECF16 I am honored to have them on the Board and have worked closely with them for a successful conference.

Fracture mechanics analysis has been successful for many years in the prevention of failures of engineering materials and structures. It is based on the realistic assumption that all materials contain crack-like defects from which failure initiates. New technological developments, however, raise new challenges for fracture mechanics research and development. Quasi-brittle materials including concrete, cement pastes, rock, soil, etc. are being extensively used in engineering applications. Layered materials and especially thin film/substrate systems are becoming important in small volume systems used in micro and nanoelectromechanical systems (MEMS and NEMS). Nanostructured materials are being introduced in our every day life. In all these problems fracture mechanics plays a major role for the prediction of failure and safe design of materials and structures. Failure of materials and structures at the micro and nano scale levels are adequately addressed at ECF16 with 93 papers referred to in this area.
More than nine hundred participants attended ECF16, while more than eight hundred fifty papers were presented, far more than any other ECF over a thirty year period. The participants of ECF16 came from 49 countries. Roughly speaking 66% came from Europe, 17% from the Americas, 8% from the Far East and 9% from other countries. I am happy and proud to have welcomed in Alexandroupolis well-known experts who came to discuss problems related to the analysis and prevention of failure in structures. The tranquility and peacefulness of this small town provided an ideal environment for a group of scientists and engineers to gather and interact on a personal basis. Presentation of technical papers alone is not enough for effective scientific communication. It is the healthy exchange of ideas and scientific knowledge, formal and informal discussions, together with the plenary and contributed papers that make a fruitful and successful meeting. Informal discussions, personal acquaintance and friendship play an important role.

I am proud to have hosted ECF16 in the beautiful town of Alexandroupolis, site of the Democritus University of Thrace and I am pleased to have welcomed colleagues, friends, and old and new acquaintances.

I very sincerely thank the authors who have contributed to this volume, the symposia/sessions organizers for their hard work and dedication and the referees who reviewed the quality of the submitted contributions. Our sponsors’ support, give in various forms, is gratefully acknowledged. The tireless effort of the members of the Organizing Committee as well as of other numerous individuals, and people behind the scenes is appreciated. I am deeply indebted to the senior students of the Department of Electrical and Computer Engineering of the Democritus University of Thrace Messrs. N. Tsiantoulas and S. Siallis for their hard work and dedication in the preparation of the ECF16 website in a timely and efficient manner and the organization of the conference, and for their efforts in helping me compile this volume. Finally, a special word of thanks goes to Mrs. Nathalie Jacobs of Springer for the nice appearance of this book and her kind and continuous collaboration and support.

January 2006

Emmanuel E. Gdoutos

Xanthi, Greece

Editor
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ECF16 TRACKS

B: TRACKS

B1: Nanomaterials and Nanostructures
1T1. Fracture and Fatigue of Nanostuctured Materials
1T2. Failure Mechanisms
1T4. Fatigue and Fracture of MEMS and NEMS
1T7. Thin Films
1T9. Failure of Nanocomposites

B2: Engineering Materials and Structures
2T1. Physical Aspects of Fracture
2T2. Brittle Fracture
2T3. Ductile Fracture
2T4. Nonlinear Fracture Mechanics
2T5. Fatigue and Fracture
2T8. Polymers, Ceramics and Composites
2T11. Fracture Mechanics Analysis
2T13. Probabilistic Approaches to Fracture Mechanics
2T14. Computational Fracture Mechanics
2T15. Experimental Fracture Mechanics
2T16. Creep Fracture
2T17. Environment Assisted Fracture
2T18. Dynamic, High Strain Rate, or Impact Fracture
2T19. Damage Mechanics
2T21. Concrete and Rock
2T22. Sandwich Structures
2T23. Novel Testing and Evaluation Techniques
2T26. Structural Integrity
2T28. Mesofracture Mechanics
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1. Fracture and Fatigue at the Micro and Nano Scales (Organized by H.D. Espinosa and I.M. Daniel)
3. Nanoscale Deformation and Failure (Organized by M. Zhou)
29. Reliability and Failure Analysis of Electronics and Mechanical Systems (O.S. Lee)
31. Multiscaling in Molecular and Continuum Mechanics – Scaling in Time and Size from Macro to Nano (Organized by G.C. Sih)
34. Cracks in Micro- and Nanoelectronics (Organized by B. Michel)
43. Interfacial Fracture in Composites and Electronic Packaging Materials (Organized by C.T. Sun and T. Ikeda)

C2: Engineering Materials and Structures
4. Fracture and Fatigue of Elastomers (Organized by C. Bathias and E. Bayraktar)
5. Integrity of Dynamical Systems (Organized by K. Hedrih)
8. Modelling of Material Property Data and Fracture Mechanisms (Organized by R. Moskovic)
9. Micromechanisms in Fracture and Fatigue (Organized by J. Pukluda and R. Pippan)
12. Interface Fracture and Behavior of Joints (Organized by L. Banks-Sills)
13. Computational Fracture Mechanics (Organized by T. Belytschko and A. Gravouil)
14. Cohesive Models of Fracture (Organized by W. Brocks)
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