

IUTAM Symposium on Multiscale Modeling and Characterization of  
Elastic-Inelastic Behavior of Engineering Materials

# SOLID MECHANICS AND ITS APPLICATIONS

Volume 114

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## *Aims and Scope of the Series*

The fundamental questions arising in mechanics are: *Why?*, *How?*, and *How much?*

The aim of this series is to provide lucid accounts written by authoritative researchers giving vision and insight in answering these questions on the subject of mechanics as it relates to solids.

The scope of the series covers the entire spectrum of solid mechanics. Thus it includes the foundation of mechanics; variational formulations; computational mechanics; statics, kinematics and dynamics of rigid and elastic bodies; vibrations of solids and structures; dynamical systems and chaos; the theories of elasticity, plasticity and viscoelasticity; composite materials; rods, beams, shells and membranes; structural control and stability; soils, rocks and geomechanics; fracture; tribology; experimental mechanics; biomechanics and machine design.

The median level of presentation is the first year graduate student. Some texts are monographs defining the current state of the field; others are accessible to final year undergraduates; but essentially the emphasis is on readability and clarity.

*For a list of related mechanics titles, see final pages.*

IUTAM Symposium on  
**Multiscale Modeling and  
Characterization of  
Elastic-Inelastic Behavior of  
Engineering Materials**

Proceedings of the IUTAM Symposium held in  
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## Contents

Preface	xi
New developments in the brittle to ductile transitions of fracture in intrinsically brittle crystals and polycrystals <i>A.S. Argon</i>	1
Dislocation-based length-scales in crystal plasticity: experiments and modeling - <i>S. Nemat-Nasser</i>	5
Application of a variational self-consistent procedure to the prediction of deformation textures in polycrystals <i>P. Gilormini, Y. Liu, P. Ponte Castañeda</i>	17
What about the yield transformation surface determination (austenite → martensite) with the measurement of austenite and martensite lattice parameters for some shape memory alloys? - <i>C. LExcellent, P. Blanc and C. Bouvet</i>	25
Micro to macroscopic deformation behavior of amorphous polymer with slightly heterogeneous distribution of molecular chains - <i>Y. Tomita and M. Uchida</i>	33
Cross slip viewed at the nano - and micrometer scale. – <i>T. Leffers and O.B. Pedersen</i>	41
A multiscale micromechanics approach to describe environmental effects on surface crack initiation under cyclic loading - <i>E.P. Busso, G. Cailletaud and S. Quilici</i>	49
Atomic - scale modeling of dislocation behaviour under stress <i>D.J. Bacon and Y.N. Osetsky</i>	59

Coalescence and evolution of nanoscale islands during polycrystalline thin film growth. - <i>M. O. Bloomfield, Y.H. Im, H. Huang and T.S. Cale</i>	67
On plc band propagation velocity under stress controlled tests in aluminium alloys- <i>M. Abbadi, D. Thevenet, P. Hähner and A. Zegloul</i>	75
Effect of some parameters on the elastoplastic behavior of green sand - <i>R. Ami Saada</i>	83
Experimental investigations of size effects in thin copper foils – <i>G. Simons, Ch. Weipert, J. Dual, and J. Villain</i>	89
Plastic response of thin films due to thermal cycling- <i>L. Nicola, E. van der Giessen and A. Needleman</i>	97
Measurement of the stress intensity factor, $k_1$ , for copper by a digital image correlation method - <i>S. M'guil, C. Husson and S. Ahzi</i>	105
Homogeneization of viscoplastic materials - <i>A. Molinari, S. Mercier</i>	113
Collective dislocation behavior in single crystalline aluminum under indentation - <i>Y. Shibutani, A. Koyama and T. Tsuru</i>	125
Multiscale modeling of texture gradient effects on localization in fcc polycrystals- <i>K. W. Neale, K. Inal and P.D. Wu</i>	133
Multiaxial plastic fatigue behavior with multiscale modeling - <i>A. Abdul-latif, K. Saanouni and J. Ph. Dingli</i>	141
Damage, opening and sliding of grain boundaries – <i>G. Cailletaud, O. Diard, A. Musienko</i>	149
Gradients of hardening in nonlocal dislocation based plasticity - <i>G.Z. Voyiadjis and R.J. Dorgan</i>	157

Determination of the material intrinsic length scale of gradient plasticity theory - <i>G.Z. Voyiadjis and R.A. Al-Rub</i>	167
Computer simulation of contact force distribution in random granular packings - <i>A.H.W. Ngan</i>	175
Three - dimensional structures of the geometrically necessary dislocations generated from non - uniformities in metal microstructures - <i>T. Ohashi</i>	183
Simulation of texture evolution in equal channel angular extrusion of copper using a new flow field <i>L.S. Toth, R. Massion, L. Germain and S.C. Baik</i>	191
Initial energy dissipation mechanism at crack tip on the ductile to brittle transition – <i>J.W. Kysar</i>	199
Constitutive modeling of viscoelastic unloading of glassy polymers - <i>Y. Remond</i>	207
On the constitutive theories of power - law materials containing voids – <i>C.Y. Hsu, B.J. Lee and M.E. Mear</i>	217
Objective quantification of the ductility within the coupling elasticity - damage behavior : formulation - <i>H. Bouabid , S.C. D'Ouazzane, M. El Kortib and O. fassi-Fehri</i>	227
Discrete dislocation predictions for single crystal hardening tension vs bending- <i>A.A. Benzerga and A. Needleman</i>	235
On plasticity and damage evolution during sheet metal forming- <i>C. Husson, C. Poizat, N. Bahlouli, S. Ahzi, T. Courtin and L. Merle</i>	243
Modeling of thermo-electro-elastic effective behaviors of piezoelectric composite mediums and analysis of reinforcement orientation effects - <i>N. Fakri, L. Azrar and L. El Bakkali</i>	251
Investigations in size dependent torsions and fractures – <i>P. Tong, D.C.C. Lam, F. Yang and J. Wang</i>	259

Influence of microstructural parameters on shape memory alloys behavior - <i>C. Niclaeys, T. Ben Zineb and E. Patoor</i>	267
Investigation of ridging in ferritic stainless steel using crystal plasticity finite element method – <i>H.J. Shin, J.K. An and D.N. Lee</i>	275
Grain boundary effects and failure evolution in polycrystalline materials – <i>W.M. Ashmawi and M.A. Zikry</i>	283
The influence of an heterogeneous dispersion on the failure behaviour of metal-matrix composites : micromechanical approach - <i>K. Derrien and D. Baptiste</i>	291
A cohesive segments approach for dynamic crack growth – <i>J.J.C. Remmers and R. de Borst</i>	299
A linear model of processing path in cubic-orthotropic system – <i>D.S. Li and H. Garmestani</i>	307
Taylor theory with microscopic slip transfer conditions. – <i>B.L. Adams, B.S. Dasher, R. Merrill, J. Basinger and D.S. Li</i>	315
Dynamics of nanostructure formation during thin film deposition. - <i>D. Walgraef</i>	325
Prediction of damage in randomly oriented short-fibre composites by means of a mechanistic approach- <i>B. Nghiep Nguyen and M.A. Khaleel</i>	333
Nonsteady plain - strain ideal plastic flow considering elastic dead zone – <i>W.Lee, K. Chung, T.J. Kang and J.R. Youn</i>	343
Multiscale modeling of non - linear behaviour of heterogeneous materials: comparison of recent homogenisation methods – <i>P. Kanouté, J.L. Chaboche</i>	351

Thermomechanical behaviour of shape memory alloy taylor's model – <i>M.O. Bensalah, L. Boulmane and A. Hihi</i>	359
Multiscale analysis of dynamic deformation in monocrystals- <i>M.A. Shehadeh, H.M. Zbib, T.Diaz de la Rubia and V. Bulatov</i>	367
Micro/meso-modeling of polymeric composites with damage evolution - <i>F. Ellyin, Z. Xia and Y. Zhang</i>	379
An alternative approach for heterogeneous material behaviour modelling. - <i>O. Bouaziz and P. Buessler</i>	389
On anisotropic formulations of the elastic law within multiplicative inelasticity - <i>C. Sansour</i>	397
Deep drawing process of the aisi 304 stainless steel cup: interaction between design tools and kinetic of plastic strain induced martensite - <i>Z. Tourki and M. Cherkaoui</i>	405
Modeling and simulation of dynamic plasticity and failure in ductile metals - <i>L. Campagne, L. Daridon and S. Ahzi</i>	413
Effects of polymeric additives on the morphology and the structure of the calcium carbonate material – <i>A. Jada</i>	421

## Preface

The papers in this proceeding are a collection of the works presented at the IUTAM symposium–Marrakech 2002 (October 20-25) which brought together scientists from various countries. These papers cover contemporary topics in multiscale modeling and characterization of materials behavior of engineering materials. They were selected to focus on topics related to deformation and failure in metals, alloys, intermetallics and polymers including: experimental techniques, deformation and failure mechanisms, dislocation-based modelling, microscopic-macroscopic averaging schemes, application to forming processes and to phase transformation, localization and failure phenomena, and computational advances. Key areas that are covered by some of the papers include modeling of material deformation at various scales. At the atomistic scale, results from MD simulations pertaining to deformation mechanisms in nano-crystalline materials as well as dislocation-defect interactions are presented. Advances in modeling of deformation in metals using discrete dislocation analyses are also presented, providing an insight into this emerging scientific technique that can be used to model deformation at the microscale. These papers address current engineering problems, including deformation of thin films, dislocation behavior and strength during nanoindentation, strength in metal matrix composites, dislocation-crack interaction, development of textures in polycrystals, and problems involving twinning and shape memory behavior.

On Behalf of the organizing committee, I would like to thank Professor P. Germain for his support and help to organize this symposium and I acknowledge the support from our sponsors: the International Union of Theoretical and Applied Mechanics; the Moroccan State Secretary for Scientific Research; the Pacific Northwest National Laboratory, WA, USA; the European Research Office of the US Army; the University Cadi Ayyad, FSSM, Marrakech, Morocco; the University of Metz, UFR MIM, Metz, France and the University Louis Pasteur at Strasbourg, UFR IPST, France

Saïd Ahzi

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