01-2 IUTAM Symposium on Material Instabilities and the Effect of Microstructure
Austin, Texas, USA, May 7-11, 2001

a) Scientific Committee

S. Kyriakides (USA, Co-Chair), N. Triantafyllidis (USA, Co-Chair),
R. de Borst (Netherlands), E. Byskov (Denmark), H.-B. Mühlhaus (Australia),
S.Q. Nguyen (France), B. Freund (USA, IUTAM repres.), O. Richmond (USA),
Y. Tomita (Japan), I. Vardoulakis (Greece)

b) Short summary of scientific progress achieved

Instability plays a crucial role in the design of solids and structures as it often limits their performance from their manufacturing stage to their installation and operation. During the last decade, this classical subject has received a new impetus from investigations at the material level. As in the more classical problems, such instabilities are governed by nonlinear interaction of geometry and material properties, which here are related to the microstructure of the material. The International Union of Theoretical and Applied Mechanics (IUTAM), recognizing the vitality of this field of solid mechanics, selected the University of Texas at Austin to host the special symposium on Material Instability and the Effect of Microstructure.

The symposium was held during May 7-11, 2001 at the Thompson Conference Center on the Campus of the University of Texas. It was conducted in the single session format of IUTAM symposia. The symposium involved a very international group of experts selected by the scientific committee to present their work on instability in a wide variety of material systems including metals, polymers, soils/granular materials, concrete, composites, active materials, cellular materials, etc. Theoretical, experimental and numerical aspects of how microstructure affects material instabilities were addressed. The varied backgrounds of the participants generated an exciting atmosphere for technical exchange on the latest advances in the field. Thirty-nine oral presentations were delivered during the five days of the symposium.

c) Countries represented and number of participants

The symposium had 65 participants, which included 6 University of Texas scientists and graduate students. The participants represented the following 14 countries: Australia, Belgium, Canada, Denmark, France, Germany, Greece, Hong Kong, Italy, Japan, Netherlands, Romania, UK, and USA.

d) Publication of Proceedings of the Symposium

The proceedings of the symposium will be published as a special issue of the International Journal of Solids and Structures with the two co-chairs of the symposium acting as guest editors. Thirty-two manuscripts have been peer-reviewed in accordance with the editorial policies of the journal. The revised papers have been submitted to

Elsevier and the processing of the volume is in progress. The volume is expected to be in print in July 2002. Hardbound volumes will be distributed to the participants, the IUTAM and the sponsors of the symposium soon after this date.

e) Financial support

The symposium received financial assistance from the following organizations:
- Air Force Office of Scientific Research, Directorate of Aerospace & Materials Science
- General Motors Corporation
- International Union of Theoretical and Applied Mechanics
- National Science Foundation, Mechanics and Materials Program

f) Scientific program

S. Kyriakides/N. Triantafyllidis (Opening ceremony)
B. Streetman (Welcome)

Opening lecture

J.W. Rudnicki , Instabilities in compacting geological materials.

Session 1

I. Vardoulakis, *Thermo-poro-mechanics of fault shearing.*
C. di Prisco, *Static liquefaction of a saturated sand stratum*.
N. Ohno, D. Okumura, H. Noguchi, *Stability of microscopic buckling modes of honeycombs subject to in-plane biaxial compression*.

Session 2

G. N. Wells, R. de Borst, L. J. Sluys, *A numerical approach for the transition from continua to discontinua in softening elasto-plastic solids*.
Yoshihiro Tomita, *Characterization of micro- to macroscopic response of polymers containing second-phase particles under macroscopically uniform deformation*.

Session 3

E. van der Giessen, T. Seelig, *Localized plastic deformation in ternary polymer blends*.
C. G'Sell, J. M. Hiver, S. Elkoun, A. Dahoun, *Experimental characterization of cavitation in solid polymers under tension, and its interrelation with necking.*

Session 4

R. Abeyaratne, *On the mobility of compound and type-I twins.*
D. Schryvers, *Changing microstructures in advanced materials studied by transmission electron microscopy.*

Session 5

J. Shaw, R. Elliott, N. Triantafyllidis, *Thermally induced martensitic transformations in atomic lattices.*
C. Faciu, *A rate-type thermo-viscoelastic approach for shape memory alloys.*
A. Vainchtein, *Thermodynamics of martensitic phase transitions and hysteresis.*

Session 6

K. Bhattacharya, P. Purohit, *Dynamics of strings and rods made of phase-transforming material.*
H.-M. Jensen, *Numerical analysis of buckling-driven delamination*.

Session 7

J. Bassani, *Patterning of plastic flow in ductile crystals*.
K. Inal, P. D. Wu, K. W. Neale, *Instabilities and localized deformation phenomena in FCC polycrystals.*

Session 8

J. Desrues, *Shear band analysis and shear moduli calibration.*
P. Lade, *Factors affecting instability of granular materials.*

Session 9

M. Bornert, P. Doumalin, J. Crepin, E. Soppa, *Strain localization in two-phase materials and polycrystals: quantitative experimental investigations and modeling attempts.*
M. Laroussi, K. Sab, A. Alaoui, *Elastic buckling in high strain compression of periodic open cell foams.*
A.M. Cuitino, Y. Wang, G. Gioia, *Inhomogeneous deformation patterns in open cell foams.*

Session 10

Richard Becker, *The role of microstructure in strain localization and fracture.*
V. Tvergaard, J. Hutchinson, Two mechanisms of ductile fracture: void by void growth versus multiple void interaction.

Session 11

A. Benallal, C. Comi, *Material instabilities in coupled problems*.
Q.-P. Sun, Z.-Q. Li, *On pattern-forming instability in shape memory alloy micro-tubes and the effect of texture.*

Session 12

T. Tzianetopoulou, M. C. Boyce, *Micromechanics of triblock-copolymer films with lamellar morphology.*
E. Fried, *Disclinations in nematic elastomers.*

Session 13

T. Vogler, S.-Y. Hsu, S. Kyriakides, *The initiation and growth of kink bands in fiber composites.*
L. Leotoing, S. Drapier, A. Vautrin, *Nonlinear interaction of geometrical and material properties in sandwich structure instabilities*.
E. Corona, J.A. Shaw, M. Iadicola, *Buckling steel bars with Lüders bands*.

Session 14

E. Byskov, J. Christoffersen, C. Christensen, J. Poulsena, *Kinkband formation in wood*.
D. Muir Wood, *Some observations of volumetric instabilities in soils.*

Session 15

F. Oka, Y. Higo, S. Kimoto, *Effect of dilatancy on the strain localization of water saturated elasto-viscoplastic soil.*
J.G.M. van Mier, C. Shi, *Stability issues in uniaxial tensile tests on brittle disordered materials.*

Session 16

Y. Leroy, *Folding and faulting of pervasively fractured geological layers.*
H-B. Mühlhaus, L. Moresi, F. Dufour, *A director theory for viscoelastic folding instabilities in multilayered rock*

Session 17

A. Needleman, E. van der Giessen, *Size effects, microstructure and localized slip.*
P. Zhang, Y. Huang, H. Gao, K. C. Hwang, *Mechanics of carbon nano-tubes: a continuum analysis incorporating the interatomic potentials*.

Report composed by S. Kyriakides and N. Triantafyllidis