TIME TABLE

TIME	Monday	Tuesday	Wednesday	Thursday	Friday
	September 10	September 11	September 12	September 13	September 14
9.00 - 9.45	Registration	Pippan	Arsenlis	Pippan	Busso
9.45 - 10.30	Arsenlis	Pippan	McDowell	Busso	Cherkaoui
11.00 - 11.45	Arsenlis	Capolungo	Pippan	Busso	McDowell
11.45 - 12.30	Arsenlis	Capolungo	Pippan	Busso	
14.00 - 14.45	McDowell	McDowell	Pippan	Cherkaoui	
14.45 - 15.30	McDowell	McDowell	Cherkaoui	Cherkaoui	
16.00 - 16.45	Capolungo	Arsenlis	Cherkaoui	Capolungo	
16.45 - 17.30	Capolungo	Arsenlis	Busso	Capolungo	

ADMISSION AND ACCOMMODATION

Applicants must contact CISM Secretariat at least one month before the beginning of the course. Application forms should be sent on-line through our web site: http://www.cism.it or by post.

A message of confirmation will be sent to accepted participants. If you need assistance for registration please contact our secretariat.

The 700,00 Euro registration fee includes a complimentary bag, four fixed menu buffet lunches (Friday not included), hot beverages, on-line/downloadable lecture notes and wi-fi internet access.

A limited number of participants from universitites and research centres who are not supported by their own institutions can be offered board and/or lodging in a reasonably priced hotel. Requests should be sent to CISM Secretariat by **July 10, 2012** along with the applicant's curriculum and a letter of recommendation by the head of the department or a supervisor confirming that the institute cannot provide funding. Preference will be given to applicants from countries that sponsor CISM.

Information about travel and accommodation is available on our web site, or can be mailed upon request.

Please note that the centre will be closed for summer vacation the first three weeks in August.

For further information please contact:

CISM
Palazzo del Torso
Piazza Garibaldi 18
33100 Udine (Italy)
tel. +39 0432 248511 (6 lines)
fax +39 0432 248550
e-mail: cism@cism.it

ACADEMIC YEAR 2012
The Nowacki Session

18th CISM-IUTAM Summer School on

MECHANICS OF NANOCRYSTALLINE MATERIALS: FROM DISCRETE TO CONTINUUM

Centre International des Sciences Mécaniques
International Centre for Mechanical Sciences

Advanced School
coordinated by

David McDowell
Georgia Technical University
GA, USA

Mohammed Cherkaoui
Georgia Institute of Technology
GA, USA

International Union for Theoretical and Applied Mechanics

Udine, *September 10 - 14, 2012*

MECHANICS OF NANOCRYSTALLINE MATERIALS: FROM DISCRETE TO CONTINUUM

Since their discovery in the early 1980s, Nanocrystalline (NC) materials have been the subject of great attention for they revealed unexpected fundamental phenomena, such as the breakdown of the Hall-Petch law, and suggested the possibility of reaching the ever-so-challenging large-ductility/high-yield stress compromise. Although the problem of describing the behavior of NC materials is still challenging, numerous fundamental, computational, and technological advances have been accomplished since then. The mechanical behavior of NC materials has been subject to numerous investigations, most of which are focused on the role of interfaces (grain boundaries and triple junctions) and aimed at identifying the mechanisms responsible for the breakdown of the Hall-Petch relation. Within this context, the mechanical behavior of NC relies on a generic idea in which grain boundaries serve as softening structural elements providing the effective action of the deformation mechanisms in NC. Therefore any modeling attempt toward the behavior of NC faces the problem of identification of the softening deformation mechanisms inherent in grain boundaries as well as the description of their competition with conventional lattice dislocation motion.
In the context of NC, this course aims at discussing a complete and rigorous state-of-the-art analysis of the modeling of the mechanical behavior of NC materials. Among other key topics the material focuses on the novel techniques used to predict the mechanical behavior of this category of nanostructured materials. Particular attention is given to recent theoretical and computational frameworks combining atomistic and continuum approaches. Also, the most relevant deformation mechanisms governing the response of NC materials are addressed and discussed in correlation with available experimental data.
The lecturers will present novel models describing plastic deformation processes occurring in NC materials, including grain boundary dislocation emission and grain boundary sliding. They will cover scale transitions from atomistic to continuum, and will show how to construct and use a molecular dynamics code for practical use in the modeling of NC materials, in addition to atomistic to continuum modeling schemes.

The course will cover a wide spectrum of materials, including: new modeling techniques and their potential applications and possible extensions, such as molecular dynamics, strain gradient based finite element simulations, and novel micromechanical schemes describing plastic deformation processes occurring in NC materials including grain boundary dislocation emission.
The course is addressed to researchers, including graduate students who are either entering these fields for the first time or actively conducting research in this area and intending to extend their knowledge of nanostructured materials.

PRELIMINARY SUGGESTED READINGS

Textbooks:
“Fundamentals of Micromechanics of Solids”, Mohameed Cherkaoui and Jianmin Qu, John Wiley & Sons, 2006.

“Atomistic and Continuum Modeling of Nanocrystalline Materials”, Mohammed Cherkaoui and Laurent Capolungo, Springer-Verlag in, 2008.

Review Papers:
Multiscale modelling of nanomechanics and micromechanics: an overview, Nasr M. Ghoniem; Esteban P. Busso; Nicholas Kioussis; Hanchen Huang, Philosophical Magazine, Volume 83 Issue 31 - 34, 2001, pp 3475 - 3528.

Viscoplasticity of Heterogeneous Metallic Materials, D. L. McDowell, Materials Science and Engineering R: Reports, 62(3), 67-123, 2008.

INVITED LECTURERS

Tom Arsenlis - Lawrence Livermore National Laboratory, CA, USA
6 lectures on: "Atomistic modeling using MD; connection to discrete dislocations". Overview of multiscale modeling – discrete; Introduction to quantum mechanics; Principles of atomistic simulation; Discrete dislocation and statistical mechanics.

David McDowell - Georgia Tech, Atlanta, GA, USA
6 lectures on: "Nanomechanics of grain boundaries and dislocation nucleation/mediation; modeling of polycrystals; Mechanics of geometrically necessary dislocations and curvature in GB-dominated scenarios". Energy minimization; Structure and unit processes for atomic rearrangement; Dislocation nucleation and grain boundary mediation; Dislocations and disclinations; Lattice curvature and generalized continua.

Mohammed Cherkaoui - Georgia Tech, Atlanta, GA, USA
5 lectures on: "Surface energy and scale effects in nanocrystalline materials; micromechanics models and multiscale modeling methods". Overview of micromechanics of polycrystals – basic methods; Effects of surface energy as function of size: nanostructures and nanocrystals; Modeling Deformation mechanisms in nanocrystalline materials: overview; Experimental insight; Deformation map; Monotonic and cyclic loading; Dislocation activity.

Laurent Capolungo - Georgia Tech Lorraine, Metz, France
6 lectures on: "GB mobility and atomistic to continuum modeling". Atomistic modeling methods; Interatomic potentials; Molecular statics and dynamics; Numerical algorithms; Quasicontinuum method.

Esteban Busso - Ecole des Mines de Paris, France
5 lectures on: "Scale dependence of deformation and ductility". Overview of scale dependent properties of polycrystalline metals; Mechanical properties of nanocrystalline metals: -Strain rate sensitivity; -Yield strength; -Ductility.

Reinhard Pippan - Austrian Academy of Sciences, Leoben, Austria
6 lectures on: "Generation by plastic deformation, deformation, fatigue, and fracture of ultrafine grained and nanocrystalline materials". Limitation of grain refinement by severe plastic deformation; Stabilization of nanocrystalline single-phase and multi-phase materials; Deformation mechanisms in nanocrystalline materials - some experimental observations; Deformation in nanocrystalline materials vs small scale plasticity; Fatigue and fracture of ultrafine grained and nanocrystalline materials.

LECTURES

All lectures will be given in English. Lecture notes can be downloaded from CISM web site, instructions will be sent to accepted participants.

MECHANICS OF NANOCRYSTALLINE MATERIALS: FROM DISCRETE TO CONTINUUM

Udine, September 10 - 14, 2012
Application Form
(Please print or type)

Surname _____

Name _____

Affiliation _____

Address_____

_____

E-mail _____

Phone_____Fax_____

Method of payment upon receipt of confirmation (Please check the box)

The fee of Euro 700,00 includes IVA/VAT tax and excludes bank charges

❑ *I shall send a check of Euro _____*

❑ *Payment will be made to CISM - Bank Account N° 094570210900, VENETO BANCA - Udine (CAB 12300 - ABI 05035 - SWIFT/BIC VEBHIT2M - IBAN CODE IT46 N 05035 12300 09457 0210900).*
Copy of the receipt should be sent to the secretariat

❑ *I shall pay at the registration counter with check, cash or VISA Credit Card (Mastercard/Eurocard, Visa, CartaSi)*

IMPORTANT: CISM is obliged to present an invoice for the above sum. Please indicate to whom the invoice should be addressed.

Name _____

Address _____

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_____

C.F.* _____

VAT/IVA* No_____

(*) Only for EU residents or foreigners with a permanent business activity in Italy.

Only for Italian Public Companies

❑ *I ask for IVA exemption (ex law n. 537/1993 - art. 14 comma 10).*

Privacy policy: I understand that data received via this form will be used only to provide information about CISM and its activities, within the limits set by the Italian legislative decree no. 196/2003 and subsequent amendments.
Complete information on CISM's privacy policy is available at http://www.cism.it/courses/privacy_statement/

I have read the "Admission and Accommodation" terms and conditions and agree.

Date _____ Signature _____