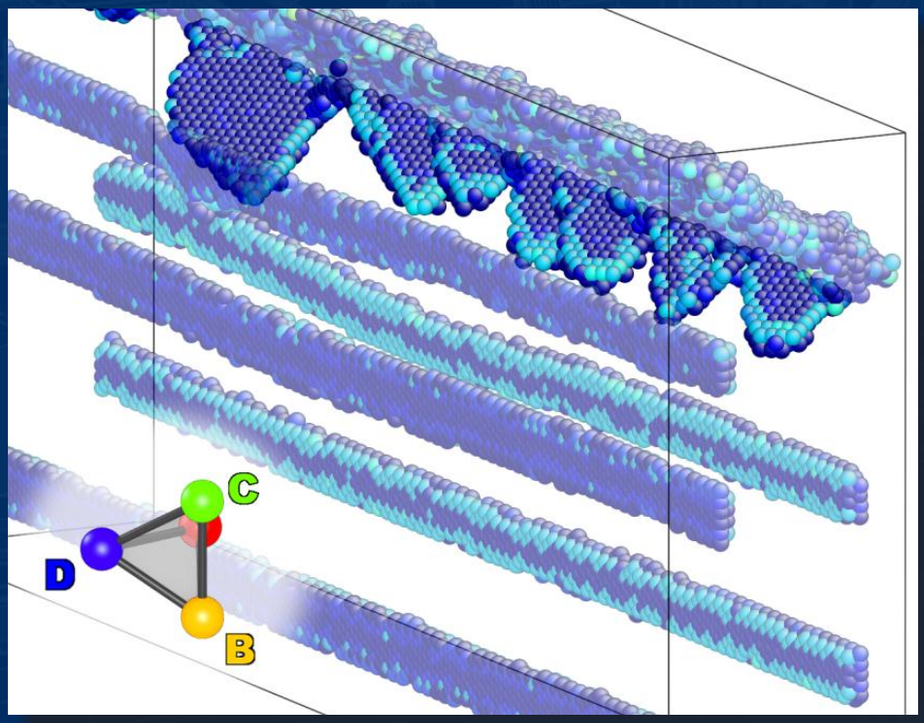
CSME BULLETIN SCGM

THE CANADIAN SOCIETY FOR MECHANICAL ENGINEERING
LA SOCIÉTÉ CANADIENNE DE GÉNIE MÉCANIQUE

Disintegration Dynamics of Dislocation Dipoles in Aluminum

Story Page 12



National Research Network on Net-Zero Energy Buildings

Story Page 8

Spring 2012 printemps

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President's Message/Message de la Présidente

Kamran Behdinan, Ph.D., P.Eng., FCSME

President's Message

I have had the privilege to serve as CSME's President since June 2010 and my term will end in June 2012. I will continue to participate in CSME activities as its past President and the Chair of Awards and Ceremony for another two-year term. During the last two years, CSME has continued to grow and in addition to its existing activities, several new initiatives were approved and implemented. These include providing free student membership for students of sustaining member universities; developing and launching the new CSME website to enhance its service and visibility; establishing partnerships with other engineering associations in support of the third members of the Engineers Institute of Canada Climate Change Technology Conference (CCTC), which will take place in Montreal at Concordia University in 2013; supporting and sponsoring several international conferences and promoting mechanical engineering in these events; and renewing the Canadian partner agreement for another five years in support of Canada's affiliation with the International Union of Theoretical and Applied Mechanics (IUTAM). In addition and perhaps most importantly, CSME has continued to recruit new members and enhance its activities to better serve its members and the community.

In the last several years, we have seen major changes in the Canadian engineering education accreditation criteria as well as in collaborative research programs. These initiatives, such as the newly introduced outcome-based accreditation system by the Canadian Engineering Accreditation Board (based on the 12 graduate attributes), as well as collaborative research programs established by NSERC, aim at enhancing the quality of engineering education and training of highly qualified personnel. This ultimately ensures Canada's education and research programs will meet industry needs for a skilled and qualified workforce. To this end, CSME has communicated the needs of the mechanical engineering profession with NSERC and EIC, and has facilitated networking among its members to showcase their strength and contributions through various technical and standing committees, communication tools such as the CSME bulletin and transaction, and regional chapters, with two of its recently appointed chairs from industry.

I would like to express sincere appreciation to Mr. John Plant, CSME Executive Director, and Ms. Louise McNamara, CSME Administrative Assistant, for their endless effort and dedication in managing the office and dealing with CSME's day-to-day operations. Furthermore, many thanks to the members of the CSME Executive Committee, as well as members of the CSME Board for their invaluable contributions and commitments to CSME.

I look forward to seeing you at the upcoming CSME International Congress in 2012. The Congress will be held at the University of Manitoba, Department of Mechanical and Manufacturing Engineering, June 4-6, 2012. The Congress Chair, Dr. David Kuhn, and his colleagues on the organizing committee, have invited internationally renowned keynote speakers, have attracted 9 symposiums encompassing all aspects of Mechanical Engineering, and have made preparation to the CSME Undergraduate Design Competition along with two workshops. This will be a 3-day event with the CSME honours, awards, and fellowships to be announced at the banquette on June 5, 2012. Also, the awards for the winning teams in the CSME Design Engineering competition and for the best paper awards will be announced.

I would like to take this opportunity to congratulate Dr. Javad Mostagimi (Professor, Department of Mechanical and Industrial Engineering, University of Toronto) who is the recipient of the Julian C. Smith Medal awarded by EIC, as well as Dr. Hossam Kishawy (Professor, Department of Mechanical, Manufacturing and Automotive engineering, University of Ontario Institute of Technology), Dr. Farrokh Sassani (Professor, Department of Mechanical Engineering, University of British Columbia), Dr. Murray Thomson (Professor, Department of Mechanical and Industrial Engineering, University of Toronto), Dr. Georgios Vatistas (Professor, Department of Mechanical Engineering, Concordia University), and Dr. Dan Zhang (Professor, Department of Mechanical, Manufacturing and Automotive engineering, University of Ontario Institute of Technology), who are the 2012 recipients of EIC Fellow (nominated by CSME).

In my last message, I would like to emphasize the importance of open communication with our members. It is our commitment to continue improving CSME and the services it provides to our members and the community. We have come a long way and I wish every success for the next President.

Sincerely yours,

Kamran Behdinan, Ph.D., P.Eng., FCSME, FPWC

NSERC Chair in Engineering Design

Professor Department of Mechanical and Industrial Engineering, University of Toronto

Director, University of Toronto Institute for Multidisciplinary Design and Innovation

Mot du président

J'ai eu le privilège de servir la SCGM en tant que président depuis juin 2010 et ce pour un mandat qui prendra fin en juin 2012. Je continuerai à participer aux activités de la SCGM comme président sortant et comme président du comité des prix et distinctions de la SCGM pour un autre mandat de deux ans. Au cours des deux dernières années, la SCGM a continué de croître, et en plus de ses activités existantes, plusieurs initiatives ont été approuvés et mis en œuvre. Citons notamment l'adhésion gratuite pour les étudiants de départements de génie mécanique membres; le développement et le lancement du nouveau site de la SCGM afin d'améliorer ses services et ça visibilité; la signature de partenariats avec d'autres associations techniques; l'appui a l'institut canadien des ingénieurs pour la 3ième Conférence sur les technologies du changement climatique qui aura lieu à Montréal à l'Université Concordia en 2013; le soutien et le parrainage de plusieurs conférences internationales et la promotion du génie mécanique dans ces événements; et le renouvellement de l'accord d'affiliation du Canada avec l'Union Internationale de Mécanique Théorique et Appliquée (IUTAM) pour cinq ans. En outre et peut-être surtout, la SCGM a continué de recruter de nouveaux membres et d'améliorer ses activités afin de mieux servir ses membres et la communauté.

Au cours des dernières années, nous avons vu des changements majeurs dans les critères

d'agrément des programmes de génie canadiens et aussi dans les programmes de recherche en collaboration. Ces initiatives, comme le nouveau système d'agrément basé sur les résultats (les 12 qualités acquises) du bureau canadien d'agrément des programmes de génie, ainsi que des programmes de recherche collaboratives mis en place par le CRSNG, visent à améliorer la qualité de l'éducation et de la formation de personnel hautement qualifié en génie. Ces efforts assureront que les programmes de formation en génie au Canada et les programmes de recherche répondent aux besoins de l'industrie pour une main-d'œuvre compétente et qualifiée. À cette fin, la SCGM renforce les besoins de la profession du génie mécanique au près du CRSNG et à l'ICI. De plus la SCGM soutiens activement le réseautage entre ses membres grâce à divers comités techniques, à des outils de communication tels que le bulletin et les transactions de la SCGM, et à ces sections régionales, dont deux des vice-présidents viennent de l'industrie.

Je tiens à exprimer mes sincères remerciements à John Plant, administrateur de la SCGM et Louise McNamara, Adjointe Administrative la SCGM, pour leurs efforts incessants et leurs dévouements dans la gestion du bureau et des opérations quotidiennes de la SCGM. De plus, un grand merci aux membres du comité exécutif de la SCGM, ainsi qu'aux membres du conseil d'administration pour leurs engagements dans notre société.

Je vous invite au prochain Congrès International de la SCGM en 2012. Le Congrès se tiendra à l'Université du Manitoba, département de génie mécanique et de fabrication, du 4-6 juin 2012. Le président du congrès, le professeur David Kuhn et ses collègues du comité organisateur, ont invité des conférenciers de renommée internationale. Ils ont organisé 9 colloques couvrant tous les aspects du génie mécanique et ont fait la préparation pour le concours de conception de premier cycle de la SCGM avec deux ateliers. Ce sera un événement de 3 jours qui inclura la remise de prix et distinctions lors du dîner le 5 juin 2012. Il y aura aussi les récompenses pour les équipes gagnantes du concours de conception en ingénierie et les prix des meilleurs papiers étudiants.

J'aimerai profiter de cette occasion pour féliciter le Professeur Javad Mostagimi (University of Toronto) pour avoir reçu la médaille Julian C. Smith décernée par la ICI, ainsi que le professeur Hossam Kishawy (University of Ontario Institute of Technology), le professeur Murray Thomson (University of Toronto), professeur Georgios Vatistas (Université Concordia) et le professeur Dan Zhang (University of Ontario Institute of Technology), nommés à titre de fellow de L'ICI.

Comme dernier message, je tiens à souligner l'importance d'une communication dynamique avec nos membres. C'est notre engagement pour continuer à améliorer la SCGM et les services qu'elle offre à ces membres et la communauté. C'est avec un immense plaisir et beaucoup d'enthousiasme que j'accueille notre prochaine présidente pour diriger la SCGM vers beaucoup de réussite.

Sincèrement vôtre,

Kamran Behdinan, Ph.D., P.Eng., FCSME

Chaire CRSNG en génie de la conception

Professeur, département de génie mécanique et industriel, Université de Toronto

Directeur de l'Institut de l'Université de Toronto pour l'Innovation et de Design multidisciplinaire

Contractually Limited Appointment in Mechanical Engineering Design

McMaster University, Department of Mechanical Engineering

Location: Ontario
Date posted: 2012-Feb-21

A new era in engineering is unfolding in the Faculty of Engineering at McMaster University, one designed to address the needs of the 21st century. Guided by a new five-year strategic plan, the Faculty is committed to promoting socially responsible engineering, advancing research for a sustainable society and developing the global engineer of the future. To this end, the Department of Mechanical Engineering is seeking an outstanding individual for a Contractually Limited Appointment in Mechanical Engineering Design. Experience in the following areas is desirable: Computed Aided Design and Manufacturing, Sustainable Design, Industrial Product Design, Design Synthesis, Design of Mechanical and Fluid Power Elements, and Geometric Dimensioning and Tolerancing.

The appointment will commence July 1, 2012 and will be initially for two years. Applicants will hold a PhD in Mechanical Engineering or a related branch of engineering with a professional engineering designation. The recruited individual will teach both undergraduate and graduate level courses, and support departmental growth in Sustainability and Mechanical Design. Applications will be accepted until the position has been filled.

Letters of application, accompanied by the applicant's curriculum vitae, and the names and addresses of at least three references are to be sent to:

McMaster University ENGINEERING

Professor S. Habibi, Chair,
Department of Mechanical Engineering,
JHE Rm. 316, 1280 Main Street West,
McMaster University, Hamilton, Ontario, Canada, L8S 4L7
email: chairme@mcmaster.ca

All qualified candidates are encouraged to apply; however, Canadian citizens and permanent residents will be given priority. McMaster is strongly committed to employment equity within its community, and to recruiting a diverse faculty and staff. The University encourages applications from all qualified candidates, including women, members of visible minorities, Aboriginal persons, members of sexual minorities, and persons with disabilities.

www.mcmaster.ca/vpacademic/academic_postings.html

CCTC 2013

3RD CLIMATE CHANGE TECHNOLOGY CONFERENCE
3e Conférence sur les technologies du changement climatique

May 27 – 29 mai, 2013
Concordia University, Montreal/Montréal, QC
www.CCTC2013.ca

CDA ACB

CSCE CGC

IEEE Canada

CGS/SCG

CNS/SNC

CSSE SCIS

CSEM/SCGI

CSBE | SCGAB

CSME/SCGM

CALL FOR PAPERS

The 3rd Climate Change Technology Conference (CCTC 2013) is a Canadian and international forum for the exchange of ideas for dealing with climate change. It is also an opportunity to keep abreast of emerging techniques and technologies for the mitigation of, and adaptation to, the impacts of climate change. The Engineering Institute of Canada (EIC) and ten of its member societies are organizing CCTC2013, which will be held on the campus of Concordia University in Montreal.

The very success of our species has led to a situation in which this planet's finite resources must be considered in all future planning. This conference is dedicated to the study and exposition of the status and prospects of engineering in support of a bright future for humanity in the midst of a rapidly changing and uncertain environment, both physical and sociological due to climate change.

The proposed conference topic categories are:

Scalable Engineering for Mitigation	**Engineering for Adaptation**
Education program & Strategy	**Risk Management**
Engineering Standards & Safety	**Modeling, Analysis & Design**
Cost Benefits and Affordability	**Alternative Solutions**
Technological & Research Advances	**Lessons Learned**
Natural Catastrophe/Disaster Planning	**Miscellaneous Topics of Interest**

Information on the previous two conferences is found at www.ccc2006.ca and www.cctc2009.ca

Interested authors/panelists are invited to submit a proposal in English or French for a paper, poster paper or presentation for the Technical Program. Paper manuscripts will be subject to peer review. Proposals should include: (a) The title and an abstract (< 400 words) providing a synopsis of the central theme; (b) The author's preferred topic category, see list above; (c) A list of full names, affiliations and contact information for the authors or panelists and (d) A designated primary contact with full contact information. Proposals should be submitted, by ***September 15, 2012***, via the Conference website at www.cctc2013.ca or sent by mail, or e-mail to: Mr. Eric Williams, Technical Subcommittee Chair, c/o Canoe-About Inc., 16 Brookview Crescent, RR#2 Tiverton, Ontario, N0G 2T0, e-mail: info@canoe-about.ca, phone: 519-396-8844.

Dates to Remember:

Proposal submission	2012/09/15;	Notification of proposal acceptance	2012/10/30
Draft manuscript submission	2012/12/15;	Acceptance notification & reviewers' comments	2013/03/0
Final manuscript submission	2013/04/03.		

For more information, please visit the conference web site at www.cctc2013.ca *(under construction at the time of publishing this document)*

Mailing address: CCTC2013, c/o Dr. John Plant, Conference Secretary, Engineering Institute of Canada, 1295 Hwy 2 East, Kingston, ON, K7L 4V1, Phone: 613 547 5989, Fax: 613 547 0195, URL: www.cctc2013.ca

CCTC 2013

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"Ingénierie pour un monde durable"

Demande de communications

La 3e conférence sur les technologies du changement climatique (CTCC 2013) est un forum international pour échanger de nouvelles informations et idées afin de faire face au changement climatique. Elle offre aussi aux participants l'occasion de se tenir au courant des techniques et technologies émergentes en matière de réduction et d'adaptation aux impacts du changement climatique. La CTCC 2013 est organisée par l'Institut canadien des ingénieurs (ICI) et dix de ses sociétés membres. La CTCC2013 se tiendra sur le campus de l'université Concordia à Montréal.

Les catégories de sujets proposées pour la conférence sont :

1. **Réduction:** Gestion des GES, énergie zéro carbone, gestion du carbone et biofixation.
2. **Adaptation**: Planification et ingénierie pour l'adaptation, procédés, outils et gestion des risques.
3. **Éducation:** Stratégies, paradigme et effet sur la profession.
4. **Modélisation:** Émissions/économie/climat, conception, systèmes énergétiques et cycle de vie.
5. **Gestion des risques.**
6. **Normes et sécurité:** Développement (inter)national de normes, protocoles, bénéfices des normes et autres initiatives.
7. **Côuts, bénéfices et abordablité.**
8. **Planification contre les catastophes/désastres.**
9. **Ce que l'expérience opérationnelle nous enseigne.**
10. **Avancées technologiques et de recherche.**
11. **Solutions de rechange – « Utiliser les moyens disponibles »**.
12. **Les soumissions relatives à d'autres sujets** pertinents seront aussi considérées.

Renseignements sur les autres conférences se trouvent à **www.ccc2006.ca** et **www.cctc2009.ca**

Les auteurs/panelistes intéressés sont invités à soumettre une proposition en anglais ou français pour un article, une affiche ou une présentation. Les articles manuscrits seront soumis à une révision par les pairs. Les propositions doivent inclure : (a) le titre et un résumé (< 400 mots) reflétant le thème principal; (b) la catégorie de sujet privilégié par l'auteur, voir la liste ci-dessus; (c) la liste des noms, affiliations et coordonnées des auteurs ou panélistes et (d) la désignation de la personne à contacter et ses coordonnées. Les propositions doivent être reçues d'ici le ***15 septembre 2012*** via le site Internet de la conférence www.cctc2013.ca par la poste ou courriel à : M. Eric Williams, Président du sous-comité technique, c/o Canoe-About Inc., 16 Brookview Crescent, RR#2 Tiverton, Ontario, N0G 2T0, courriel : info@canoe-about.ca, tél : 519-396-8844.

Dates importantes :

Envoi des propositions	2012/09/15	Avis d'acceptation des propositions2012/10/30
Envoi des ébauches de manuscrit	2012/12/15	Avis d'acceptation et commentaires des réviseurs
Envoi des manuscrits finals	2013/03/13[1]	2013/03/01

Note 1 : **pour être inclus dans le DVD/CD des actes de la conférence.**

Pour plus de renseignements, visitez www.cctc2013.ca

Adresse postale: CCTC2009, c/o Dr. John Plant, Secrétaire de la conférence, Institut canadien des ingénieurs, 1295 Hwy 2 East, Kingston, ON, K7L 4V1, Tel: 613 547 5989, Fax: 613 547 0195, Url : www.cctc2013.ca

NSERC APPROVES NATIONAL RESEARCH NETWORK ON NET-ZERO ENERGY BUILDINGS

David Naylor, FCSME
Professor, Department of Mechanical & Industrial Engineering, Ryerson University

Residential and commercial buildings consume large amounts of energy for heating, cooling, lighting, hot water and appliances. At present, they account for about one third of Canada's energy use and greenhouse gas emissions. Buildings also place a significant strain on the electrical grid, consuming over half of Canada's electrical generation capacity, and contributing significantly to peak loads.

A new strategic network, recently approved by Natural Science and Engineering Research Council of Canada (NSERC) aims to reduce the impact buildings have on the environment and our power grid. In December 2011, NSERC announced the funding of the Smart Net-Zero Energy Buildings Strategic Network (SNEBRN). The research of SNEBRN will be aimed at promoting the widespread adoption of net-zero energy buildings design and operation concepts, which are optimized for various climatic regions in Canada.

In the context of this network, a net-zero energy building is defined as one that, in an average year, produces as much electrical plus thermal energy from renewable energy sources as it consumes. So, in addition to studying ways to minimize building energy consumption, the network will investigate mechanisms that allow the building to act as an energy generator -- this includes technologies such as building integrated photovoltaic systems, and advanced solar thermal systems for space and domestic hot water heating.

SNEBRN is lead by Dr. Athienitis, a Tier 1 Canada Research Chair and professor at Concordia University. Through his leadership, this strategic network brings together twenty-nine researchers from fifteen Canadian Universities, along with many partners from government and industry. The government partners include the CanmetENERGY laboratory of Natural Resources Canada, Hydro-Québec and Canada Mortgage and Housing Corporation. A broad range of industrial partners have also pledged support and active involvement, including Philips (lighting and appliances, energy management), Alouette Homes and Kott Group (prefabricated home manufacturers), Régulvar (automation), Unicel (curtain walls) and Canadian Solar (PV manufacturer). The cash support from partners is about $1.7 M and in-kind support exceeds $2 M. The funding from NSERC is $5 M over five years (2011-2016).

The SNEBRN research proposal identifies five main research themes:

Theme 1: *Integrated Solar and HVAC Systems for Buildings*. This Theme will cover solar thermal systems for space heating/cooling and service hot water heating, building-integrated photovoltaic (BIPV) systems and solar assisted- and ground-source heat pumps. These systems and components must be optimally integrated among themselves and, also with conventional HVAC systems and the building envelope systems covered by Theme 2.

Theme 2: *Active Building Envelope Systems and Passive Solar Technologies*. This Theme will cover the integration of advanced solar systems such as building-integrated photovoltaic/thermal (BIPV/T) systems, active daylighting systems, and advanced windows systems, including curtain walls for commercial buildings. Also considered will be prefabrication of envelope systems, a means to reduce costs and increase quality through mass production in a factory environment.

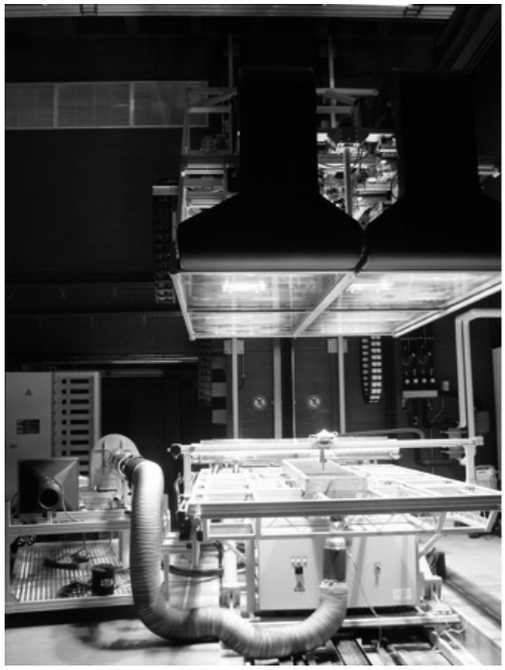
Theme 3: *Mid-to Long-term Thermal Storage for Buildings and Communities*. This Theme will deal with the storage of excess thermal renewable energy when it is not immediately required. The thermal storage may be a building-integrated mass, a central active storage system such as tanks of water, or an earth storage working through buried pipes. It will

also consider district heating/cooling. This Theme will have a major component-link to Theme 1.

Theme 4: *Smart Building Operating Strategies*. This Theme will develop ways to integrate the control of all building subsystems so as to optimize the net renewable energy fed into the grid and the electricity demand profiles. Techniques such as predictive control based on weather forecasting and online prediction of building response will be employed, and there will be a crossover with projects in Theme 5.

Theme 5: *Technology Transfer, Design tools, and Input to National Policy*. This Theme includes many facets: the coordination and implementation of demonstration projects, technology transfer, development of design tools and guidelines (especially for engineers and architects), input to codes and standards, and national policy. This will be an overarching theme, with strong links to the many of the network's projects.

The primary goal of SNEBRN is to investigate the best ways to achieve zero average annual energy consumption at both the building and neighbourhood levels through combinations of passive systems and dynamic building envelope technologies. A unique feature of the proposed research to be done by SNBRN is the whole-building systems approach. SNEBRN Scientific Director, Dr. Athienitis says that "We are on the threshold of a major change in building design. For the first time, we are looking at the building envelope, fenestration, HVAC systems, solar energy production, and the control systems *all together*. The focus of the network is to bring these technologies together in an optimal way."



The recently acquired Solar Simulator and Environmental Test Chamber Facility at Concordia University, shown above, will play a major role in supporting the SNEBRN research program.

OFFRE D'EMPLOI

ÉCOLE POLYTECHNIQUE MONTRÉAL

Concours n° : 12-P-1
Début de l'affichage: vendredi 24 février 2012
Fin de l'affichage : mardi 24 avril 2012
Titre du poste : Professeur en génie mécanique/aérospatial - Professor of Mechanical/Aerospace Engineering
Unité administrative: Département de génie mécanique
Supérieur immédiat: Sylvain Turenne
Lieu de travail : Tous les pavillons

SOMMAIRE DU POSTE
L'École Polytechnique de Montréal, l'un des plus importants établissements d'enseignement et de recherche en génie au Canada, comptant plus de 6 500 étudiants et plus de 1 000 personnes à son emploi, est à la recherche de candidats pour combler un poste de professeur de génie aérospatial. Le département de génie mécanique de l'École Polytechnique désire consolider et renforcer ses champs d'expertise en génie aérospatial, et sollicite des candidatures pour combler un poste de professeur adjoint ou agrégé.

Le candidat devra posséder une expertise en aérodynamique interne ou en combustion ou en aérothermique des systèmes aéronautiques (aspects thermiques et thermodynamiques). Seront considérées aussi bien les candidatures proposant une approche numérique (modélisation et simulation) que celles préconisant une approche expérimentale.

Programme de génie aérospatial
Le programme de génie aérospatial a pour but de former des ingénieurs qui travailleront aux différentes phases de la conception et de la production d'aéronefs et d'engins spatiaux. Cette formation inclut les domaines de l'aérodynamique, de la propulsion, de l'analyse des structures, des systèmes embarqués et des technologies spatiales. Ce programme est développé de telle sorte que le secteur industriel soit très impliqué dans la formation des étudiants.

POSITION SUMMARY
Polytechnique Montréal is one of Canada's leading engineering schools and the largest in Québec in terms of its student population and the scope of its research activities, with nearly 6,500 students and 1,000 employees. Polytechnique Montréal is seeking applicants to fill a position of professor of aerospace engineering. The mechanical engineering department seeks to strengthen and consolidate its expertise is aerospace engineering and solicits applicants at the rank of assistant or associate professor.

The applicant must have expertise in internal aerodynamics or combustion or in thermal and thermodynamic aspects of aeronautical/aerospace systems. Applicants proposing experimental approach as well as those proposing computational methodologies will be considered.

Aerospace engineering program
The aerospace engineering program focuses on training engineers to work in the various phases of design and production of aircrafts and spacecrafts. This training covers the areas of aerodynamics, propulsion, structure analysis, on-board systems and space technologies. The program was developed in such a way that the industrial sector is highly involved in training students.

FONCTION
La personne devra exercer avec dynamisme et créativité les fonctions de base associées à ce poste. Elle devra notamment:

- développer une activité de recherche originale de nature fondamentale présentant un potentiel de retombées industrielles à moyen et long terme;
- diriger les travaux de recherches d'étudiants aux cycles supérieurs;
- exceller en enseignement à tous les cycles;
- enseigner les cours de premier cycle en transfert de chaleur, thermodynamique, et dynamique des fluides.

MAJOR RESPONSIBILITIES
The successful candidate will be expected to carry out the basic duties of this position with a dynamic and creative approach. In particular, he or she will:

- develop original research activities presenting good potential for mid to long term industrial impact;

- supervise the research activities of graduate students;
- excel at teaching at both the undergraduate and graduate levels;
- teach undergraduate courses in heat transfer, thermodynamics and fluid dynamics.

EXIGENCES DU POSTE
La personne recherchée doit détenir un baccalauréat en génie aérospatial ou en génie mécanique, et un doctorat (Ph.D.) dans une spécialité pertinente. Elle doit être membre de l'Ordre des ingénieurs du Québec ou habilitée à le devenir pendant son premier contrat. La langue d'enseignement à Polytechnique est le français.

ESSENTIAL QUALIFICATIONS
Applicants must hold a bachelor's degree in engineering and a doctorate (PhD) in aerospace engineering, mechanical engineering or a related field. The successful candidate will be a member of the Ordre des ingénieurs du Québec (OIQ), or take the necessary measures to become a member during his or her first contract. The working language is French.

RÉMUNÉRATION
Ce poste mène à la permanence. Le traitement et les avantages sociaux sont déterminés selon les dispositions de la convention collective en vigueur.

DATE D'ENTRÉE EN FONCTION: À déterminer

CONDITIONS OF EMPLOYMENT
This faculty position is tenure-track. Salary and benefits will be set in accordance with the collective agreement between Polytechnique Montréal and its professors.

START DATE: To be determined

MISE EN CANDIDATURE
Les candidats sont invités à soumettre leur curriculum vitae, un énoncé décrivant leurs intérêts et objectifs en enseignement et en recherche ainsi qu'une description de leurs réalisations, des évaluations d'enseignement, une copie de leurs diplômes, les noms de trois répondants capables de témoigner de leur expérience et de leurs habiletés en enseignement (inclure l'adresse, le numéro de téléphone et de télécopieur ainsi que l'adresse électronique), quelques exemples de travaux reliés au poste ainsi que des tirés à part de contributions récentes.
Le tout doit être envoyé au plus tard le 24 avril 2012, à 16h30, à l'attention de :
Professeur Sylvain Turenne, ing., Ph.D.
Directeur
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Le présent affichage pourrait être prolongé au-delà du 24 avril 2012.

APPLICATIONS
Candidates should submit an application package that consists of a curriculum vitae, a statement of teaching goals and research priorities and a description of objectives and achievements, records of teaching effectiveness, a copy of their diplomas, the names of three references who can attest as to the applicant's experience and his teaching abilities (include address, telephone and fax numbers, along with an e-mail address), several examples of work relevant to the position and examples of recent contributions.
Application packages should be received no later than April 24th, 2012, at 4:30 p.m. at the following address:
Professor Sylvain Turenne, Eng., Ph.D.
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This posting may be extended past April 24th, 2012.

DISINTEGRATION DYNAMICS OF DISLOCATION DIPOLES IN ALUMINUM

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Abstract

The disintegration process of dislocation dipoles in pure Aluminum is studied via large scale molecular dynamics simulations. The investigation concerns a scenario where a series of dislocation dipoles pile up on a grain boundary (GB). It is found that the disintegration process involves an intricate series of dislocation-dynamics events. A variety of crystalline defects are produced during the disintegration, these include stacking fault disks, Lomer-Cottrell junctions, a system of stacking fault tetrahedrons (SFT) and rolls of vacancies. In particular, a batch SFT formation mechanism is observed, where a system of SFT is nucleated simultaneously, and that the group of SFT exhibit uniformity in both position and orientation. A thorough description of the dislocation dynamics is presented. In addition, a high density of sessile defects is observed to be confined within the dipoles. It is therefore illustrated that the disintegration process constitutes a highly localized hardening mechanism.

Keywords: Dislocation dipole, annihilation, stacking fault tetrahedron, Lomer-Cottrell, Molecular dynamics simulation.

1. Introduction

The presence of dislocation dipoles is an essential feature in fatigue mechanisms. In particular, a high density of dipoles is found in ductile materials that are subjected to cyclic loading. These dipoles are bundled in the form of persistent slip band (PSB). The dipoles during a fatigue process are known to undergo annihilation, leaving a large amount of crystalline defects. Such phenomenon is identified as a key process in a fatigue crack initiation. Currently, several theoretical models for fatigue life prediction are built solely on the picture of dislocation dipoles piling up on a grain boundary (GB) and also on free surface. Therefore, the motivation of this study is to investigate the fine details of the disintegration process of dislocation dipoles at the atomic scale.

Gilman and Johnston[1] were the first to infer the presence of dislocation dipoles in fatigued materials. Their experimental study suggested that these dipoles are formed via a double cross-slip mechanism. Later, numerous studies echoed this finding and established an essential role of dislocation dipoles in fatigue crack initiation. On this topic, Christ[2] considered a scenario where dislocations, in the form of dipoles, are piled up on a grain boundary. Based on geometric arguments and the saturation vacancy concentration in a PSB, he established a theoretical model for the stress required for a PSB-GB crack formation. In regards to the nature of dipoles in fatigue samples, Essmann and Mughrabi[3] provided strong experimental evidences that these dipoles undergo annihilation. Their study on fatigued copper using transmission electron microscopy has demonstrated that edge-dislocation dipoles annihilate spontaneously by decomposition into '*invisible debris*'. In their later works[4], a comprehensive discussion was given on the role of edge dislocation annihilation in a PSB. In regards to the kinetics, they proposed an annihilation process caused by dislocation gliding. The net effect is to tilt the effective slip plane away from the crystallographic slip plane. However, Repetto and Ortiz suggested otherwise[5], they proposed that the same annihilation process can be explained by climb instead of glide. Other authors made effort to settle this controversy by suggesting their own annihilation mechanisms. Strunk[6], Quesnel[7] *et al* proposed glide mechanisms for edge dislocation annihilation in different crystal systems. In general, it is now accepted that dipoles annihilate via climb occurring at high temperature in distinction to the glide mechanism.

In regards to fatigue life, Tanaka and Mura[8] evaluated several scenarios where dislocation dipoles pile up on a GB or a surface. They formulated a fatigue life model based on the strain energy accumulation as dislocation dipoles pile-up. Their model and various other extended versions are widely adopted in explaining fatigue problems. These pioneering works have demonstrated the important role of dislocation dipoles in fatigue problems. However, the atomic process of dislocation dipoles accumulation and disintegration has not been investigated in detail. In particular, little is known about the dislocation dynamics when a series of dipoles are present.

Dislocation dipoles heights are in the ranges of nanometres. The internal dynamics of annihilation is difficult to observe experimentally. Atomistic simulation is therefore a natural choice for the investigation. Most previous numerical studies on this topic focused on specific dislocation dynamics and considered a single dipole system[9,10]. Distinguishing from these previous works, here we present a study that utilizes large scale molecular dynamics simulation in a wider perspective by incorporating a group of dislocation dipoles in a pile up scenario. It is a simplified model designed to illustrate the disintegration dynamics of a group of dipoles.

2. Methodology

A massively parallelized molecular dynamics simulation code is developed for the purpose of this study. The program employs a three-dimensional Newtonian molecular dynamics algorithm as the simulation platform. Temperature is controlled via rescaling the kinetic energy at every 500 steps. The atomic trajectory is evaluated by the 5th order Gear predictor-corrector algorithm[28]. Sample sizes of up to 3.4 millions of aluminum atoms and a dimension of 374Å × 360Å × 434Å are tested. The thicknesses in the *z* direction are chosen to satisfy the periodic boundary condition. Atoms are arranged into a bi-grain system with the relative orientation of the two grains extending a periodicity of a *coincident site lattice* (CSL). A Σ11($\bar{7}\bar{7}4\bar{1}\bar{1}$) asymmetric grain boundary is chosen for the study for its tendency to hinder dislocation transmission. The CSL system can be fully described by the rotational matrix[22], R:

$$R=\frac{1}{11}\begin{bmatrix} 6 & -6 & 7 \\ -9 & -2 & 6 \\ -2 & -9 & -6 \end{bmatrix} = N^{-1}[a_{ij}]\frac{1}{11}\begin{bmatrix} 6 & -6 & 7 \\ -9 & -2 & 6 \\ -2 & -9 & -6 \end{bmatrix} = N^{-1}[a_{ij}] \qquad (1)$$

From this matrix, the rotation axis, ***c***, and the ration angle, θ can be evaluated by[22]:

$$\boldsymbol{c} = \{a_{32} - a_{23}, a_{13} - a_{31}, a_{21} - a_{12}\} \qquad (2)$$

$$2\cos(\theta) + 1 = N^{-1}(a_{11} + a_{22} + a_{33}) \qquad (3)$$

giving $\boldsymbol{c} = \{-5, 3, -1\}\boldsymbol{c} = \{-5, 3, -1\}$ and $\theta = 82.2°\theta = 82.2°$. This configuration provides both a tilt and a twist component to the grain boundary and therefore prevents slip systems to adjoin continuously. The arrangement introduces slip system incompatibility and discourages dislocation transmission.

Interactions between atoms in the simulation are governed by a many-body interatomic potential. The form of the potential is of type embedded atom method (EAM) and is described by[21]:

$$E_i = F_i(n_i(r)) + \frac{1}{2}\sum_{j\neq i} V_{ij}(r_{ij}) \qquad (4)$$

where $F_i F_i$ is the energy required to embed an atom into a local net charge density, nn, which is the sum of charge density from each neighbouring atoms, namely: $n_i = \sum \rho_j(r_{ij}) n_i = \sum \rho_j(r_{ij})$ and V_{ij} is a pair potential describing the direct interaction between two atoms. The potential used in this study is given by ref [21]. This potential is constructed under the 'force-matching' scheme. Electronic density of atoms was evaluated using first-principle numerical calculations. The atomistic force and the potential energy were then reconstructed from the electronic density. Such potential can provide an accurate description in both the atomic trajectory and the energetic. Before each simulation, the initial system is relaxed according to this energy functional. The conjugate gradient method is employed at 0 K for 1000 steps. The given relaxation time is found to be sufficient to relax and stabilize the total energy of the system.

The number of atoms available for atomistic simulation is rather limited at the current capabilities. It is therefore necessary and important to deploy appropriate boundary conditions. Steps have been taken to verify the validity of the conditions applied and to eliminate possible artifacts due to size limitation. For the ±*x* and -*y* faces, i.e. the planes with outward normal in the ±*x and -y* direction (figure 1), both fixed and free conditions were tested. Under real-life condition, the simulated region should be surrounded by other atoms. Assuming the simulated region interacts with the surrounding elastically, one would expect its behaviour lies between the results of the two boundary conditions. The two conditions were examined and no phenomenological differences were found. Some small deviations in quantitative observables like energy and stresses were measured. The differences were found to be less than 2% close to the boundary and 0.1% in the region of interests. These differences would be considered small and negligible. The small difference in stress implies a weak long-range interaction for the dipoles away from the slip planes. Size and boundary condition in *z* direction is more critical as the *z* faces always coincide with the region of interest and across most of dislocation lines. Multiple thicknesses in the z direction were tested under both periodic and free boundary conditions. The largest configuration has a thickness of 434 Å and is four times that of the thinnest configuration. Adjusting the thickness would induce possible size dependent artifact which, if observed, would invalidate the simulation. But for the configuration considered in the present study, no phenomenological differences were observed.

Our simulations were performed under the canonical ensemble with a controlled temperature of 5 K. The low temperature is chosen to isolate any thermally-activated processes. Processes such as vacancy diffusion and dislocation climb are not of the focus in this study. Nevertheless, we believe these are important processes in high temperature fatigue mechanisms, and should be dealt with in a separate investigation.

3. Results and Discussions

3.1 Dislocation Dipoles Pile-up

The scenario studied here considered that the dislocation dynamics is driven by the increasing stress as dislocation dipoles accumulates. Dislocations on the same glide plane are mutually repulsive. In the simulation, dislocations are presumed to have generated from a virtual dislocation source far away from the simulation space. This scenario is most resemblance to the high-cycle-fatigue (HCF) loading condition, where very limited dislocation sources are activated by the small cyclic-strain amplitude. In a real-life HCF scenario however, dislocations are generated at each cyclic loading. The time scale at which it happens is out of reach for molecular dynamic simulations at its current capability. It is therefore important to emphasize that the presented study is a numerical model. The setup is design to capture the essence dynamics of dislocation dipoles as they pile-up and disintegrate. To model the scenario, a constant strain rate of 0.5mÅ/fs is introduced to a small section of atoms at the edge of the simulation space during a simulation. The strained section is far away from the grain boundary where disintegration would occur. The straining motion is in the direction antiparallel to the slip vector $[10\bar{1}\bar{1}]$. It roughly resembles the time-averaged strain as a series of edge dislocation dipole slowly enters the simulation region. The model can be viewed as a time-elapse of dislocation dipoles pile-up. Implicit to this model is the assumption that: 1) dislocation dipoles configuration remain intact during each cyclic loading before the disintegration. 2) stress from the accumulation of dislocations is the sole cause for the disintegration process.

3.1 Interaction between Dislocation Dipoles and Grain Boundary

To simulate a dislocation dipole, edge dislocations are generated on two slip planes *in-situ* during the simulation. A small section of the atoms along the edge of the system is subjected to a constant strain rate of 0.5mÅ/fs in a direction antiparallel to the slip vector $[10\bar{1}\bar{1}]$. This creates pairs of edge dislocations on the slip planes (figure 1). The dipole height is chosen to be 4.55nm. This value is consistent with experimental observation on aluminum reported[11]. The configuration resembles edge dislocation dipoles of vacancy type, defined by having extra half planes on the outward normal direction (figure 1b). These edge dislocations are unstable in FCC system and are immediately dissociated upon entering the simulated region. The dissociation follows the reaction equation, $BC \rightarrow B\alpha + \alpha C$ $BC \rightarrow B\alpha + \alpha C$, in terms of Thompson tetrahedron notation, and yields two Shockley partials from each perfect edge dislocation. The pair of partials is connected by a stacking fault. This configuration is sometimes referred to as a stacking fault ribbon. The separation distance between a pair of partials is governed by the stacking fault energy between them. As the stacking fault energy in aluminum is high, the dissociated partials are bounded together closely. An average separation of 12±3Å is measured in our numerical simulation,

which is consistent with first principle calculations and experimental observations[12]. These Shockley partials are free to glide on their slip planes and are driven toward the GB by a shear stress. The shear stress is induced by the constant strain rate introduced to the system. These dissociated edge dislocations are primitively assembled in a zigzag pattern along the dipole while gliding toward the grain boundary, as illustrated in *figure 1*. Such formation is a result of the attraction from the adjacent plane and the mutual repulsion within the same plane[24]. Consequently, dissociated edge dislocations arrive at the GB in an alternating manner, with dislocations on plane A arriving first. Dislocations that first reached the GB are absorbed. After absorption of several dislocations, back stress start to build up, which impedes further dislocation motion. As a result, ribbons of dislocations are then piled up along the two dislocation planes.

In our simulation, it is found that a few consecutive pairs of partial dislocations were absorbed by the GB before reemission begins. During the reemission process, an array of partials with Burgers vector, *γB,* nucleate at the GB. *Figure 2* illustrates the array of partial dislocations being emitted. Each Shockley partial forms as stacking fault disk and emerging from the grain boundary. Subjected to a strong bowing force, the disks expand radially. The sideway expansion ceases when its perimeter reaches the two dislocation planes. However, these disks continue to expand in the *BD* direction and sweep along the trailing dipoles. As disks continue to expand, a second partial dislocation arc is bow out at the location where the first disk nucleated. The second dislocation arc, having a Burgers vector of *Aγ* is complementary to the first disk; removing the stacking fault within its perimeter. *Figure 3* demonstrated the unfaulting mechanism. The second dislocation arc, behaving similarly to the first arc, expands radially. While both arcs are expanding anisotropically, as being bounded by the dislocations planes, the second loop cuts the stacking fault disk into two uneven parts. The larger parts continues to sweep along the dipole, crossing and interacting with stacking fault ribbons on the two planes while the smaller part is partially being re-absorbed by the GB and becomes stationary for the rest of the simulation time.

3.2 Nucleation of Vacancy Clusters and Lomer-Cottrell Locks

The stacking fault disks that sweep along the dipole are found to cross several dislocations ribbon. They react to the trailing partials on the ribbon according to the equation: $\gamma B + B\alpha \rightarrow \gamma\alpha\gamma B + B\alpha \rightarrow \gamma\alpha$ (figure 3). The resultant Burgers vector is not on any FCC slip planes, the dislocation is therefore sessile and cannot glide in any direction. This structure is identified as a Lomer-Cottrell junction or Lomer-Cottrell locks as some authors prefer. It is stable and immobile at low temperature and it can only transform or translate via climb or dissociation (unzipping motion)[16]. At the early stage of annihilation process, these junctions are found to be aligned in parallel with the CA direction and they are distributed throughout the dislocation planes. The formation of these Lomer-Cottrell junctions has two eventual consequences: firstly, it provides an anchor where other dislocations can meet, this results in the nucleation of point defects. Secondly, it distorts the dislocation line of piled-up partials, which encourages the formation of stacking fault tetrahedrons.

In regards to vacancy nucleation, it is found that multiple vacancies nucleate into a roll formation along the Lomer-Cottrell junction. Each reactant partial of the sessile dislocation has an unfaulting counterpart which is trailing behind. Under the influence of local stress, short sections of these trailing partials meet at the junction. These trailing partials are unable to cross the sessile junction. As a result, they conjoin together. The conjoined configuration constitutes a large junction structure. The net dislocation reaction is $A\gamma + \gamma B + B\alpha + \alpha C \rightarrow CAA\gamma + \gamma B + B\alpha + \alpha C \rightarrow CA$. This reaction resembles a partial annihilation process with a net reduction in Burgers vector. The reduction in magnitude of Burgers vectors manifest in some vacancy spaces. Each vacancy space is slightly smaller than a normal vacancy in volume and can be considered as a partial point defect[20]. It is observed that these vacancy spaces align in a roll formation of up to 8 atomic sites in length, as illustrated in Figure 4. It is found that most of these rolls of vacancy persist throughout the simulation and retain their form. As simulation proceeds, some of these vacancy rolls are found to enrol in further dislocation reaction and annihilated into some rolls of whole vacancy.

3.3 Batch Formation of Stacking Fault Tetrahedrons

In addition to vacancy nucleation, our simulation also reveals a batch formation process for the stacking fault tetrahedron (SFT). Unlike the mechanisms suggested previously[13,14,15], our proposed model does not involve vacancy clusters aggregation, nor the

formation of Frank partial loops. Our simulation is specific to dipole annihilation scenarios where multiple parallel stacking fault disks form as a result of dislocation dipole-GB interaction. It involves the interaction between the arrays of reemitted stacking fault disks and the stacking fault ribbons piled-up on the dislocation planes. It is found that a large number of SFT can be nucleated simultaneously through this process. As illustrated in figure 5, the resulting SFTs are positioned systematically and share a common orientation.

The Lomer-Cottrell junction discussed previously has a Burgers vector of $\gamma\alpha$, which is not perpendicular to any of the partials on the ribbon. When the junction bisects the ribbon, it interacts elastically with partials on the two sides in an opposite manner. As illustrated in *figure 3*, on the right side of the ribbon, the sessile dislocation drives the two partials away, enlarging the stacking fault region. On the other side, partials are being driven together. The distorted dislocation lines are under the influence of Peierls potential, favouring the alignment on the edges of the Thompson tetrahedron. As a result, $B\alpha$ and αC partials are forced to align with the CD and BC direction respectively. In the process, local competitions take place between junctions on the same ribbon. Through maintaining the CD alignment, some junctions are pushed downward via an zip-unzip mechanism discussed previously by Rodney[16], Hussein[17], *et al*. Consequently to all these dynamics, a network of aligned triangular stacking fault plates is created. These orderly situated triangular plates and their connected stacking fault disk on the γ plane will become two planes on stacking fault tetrahedrons.

Later in this formation process, upon triangular plates acquired their equilateral shapes and stabilized, the third SFT plate nucleates via a spontaneous emission of a Shockley partial on the CD edge, initiated either from the C or D apex, figure 6e. The emission is equivalent in principle to the cross slip mechanism proposed by Fleischer[18]. It is suggested that a Shockley partial can cross slip at a slip plane intersection via degenerating into a sessile dislocation and another Shockley partial. In our case, the new partial glides from the CD edge to the AD edge, completing the third plane of an SFT. As Kadoyoshi *et al* pointed out[19] that there exists a critical size at which SFT is stable. In our simulation, it is found that those SFTs with a triangular base less than 32 atomic sites were spontaneously collapsed into vacancies. Those clusters are found to collapse within the dislocation planes. Those that are capable of forming the third plates on the β plane are stable, some of them remain open or partially open throughout the simulation. Some SFTs are able to complete forming the last face at the later period of the simulation, again via spontaneous partial emission at the C apex. The last plate of the SFTs remains difficult to close due to the fact that this plate is perpendicular to the strain direction. This orientation receives minimal resolved shear stress, and therefore the process relies on the assistance of local stress state

The observed SFT formation mechanism has several implications. Firstly, the α plane of a SFT must resides on a dislocation plane. This creates a bias in sessile dislocation density toward the two planes as expected, as a dipole has its dislocations entirely on those two dislocation planes before the disintegration. However, unlike the original Shockley partials, these dislocations are sessile, stable and irreversible. As such, their presence effectively diminishes the shear-ability of these two planes. Secondly, this mechanism illustrates the role of SFT formation as an intermediate step for vacancy nucleation. It is known that vacancies can form during annihilation of a dipole. However, the mechanism is poorly understood, in particular to the question on how two line defects annihilate to form point defects. This simulation illustrated that a stacking fault ribbon is dissected into discrete triangular pieces in the process of SFT formation. As such, creation of these SFT structures become a necessary intermediate step for the formation of discrete vacancy clusters.

4. Conclusion

In summary, when vacancy dipoles pile-up at a GB, annihilation of dipoles can be initiated by a grain boundary via emission of partial dislocations. It is found that the reemitted partials interact with stacking fault ribbon on the dislocation planes to form sessile Lomer-Cottrell junctions. Some sections of these junctions are found to undergo further dislocation reaction, and nucleate rolls of partial point defects and vacancies, while some other sections nucleate into stacking fault tetrahedra. An SFT nucleation process is observed at which it involves the nucleation of a batch of SFT on the dislocation planes simultaneously. These SFT exhibit uniformity in both position and orientation. Some of these SFTs are found to collapse into vacancies inside the two dislocation planes. The high concentration of sessile dislocations and vacancies generated implies a highly localized hardening mechanism.

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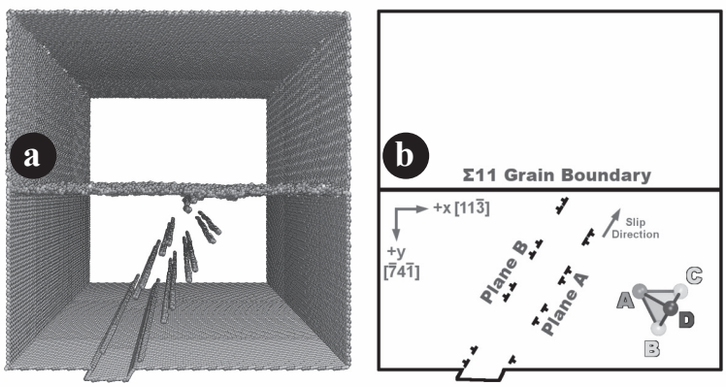


Figure 1: Dislocations in dipole formation marching toward the grain boundary.
(a) coordination number coloring (b) schematic illustration

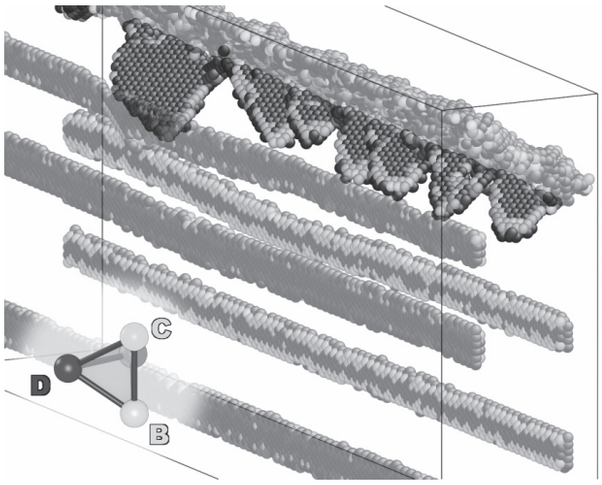


Figure 2: Stacking Fault Disks being emitted at the grain boundary. Color in central symmetry parameter.

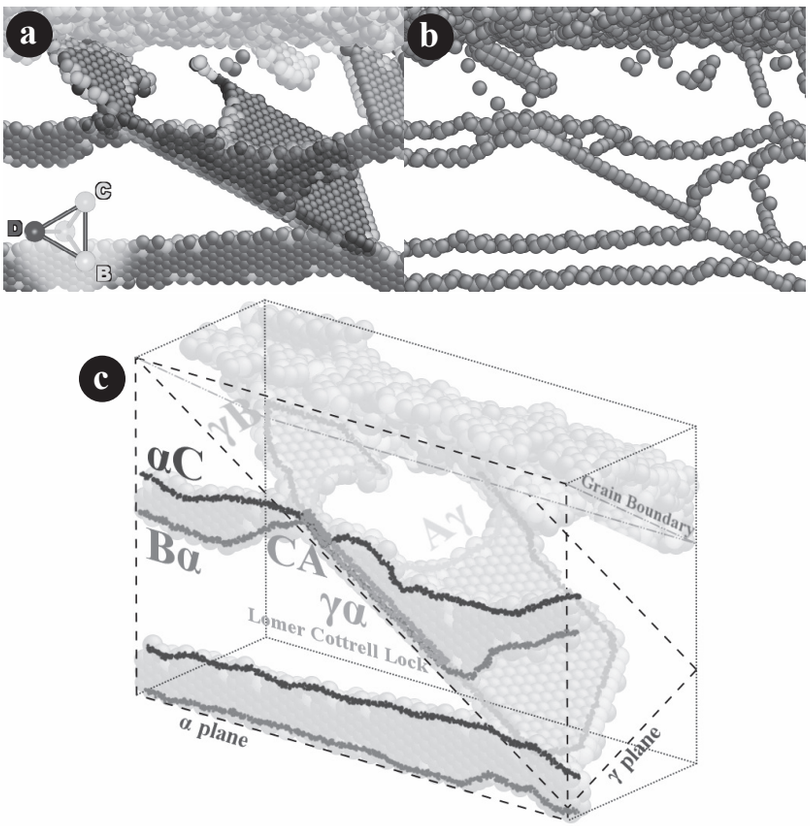


Figure 3: A stacking fault disk emerges from the grain boundary and is intersecting a stacking fault ribbon (disassociated edge dislocation). A row of partial point defects nucleate along dislocation CA. Their presence is illustrated by green atoms next to the vacancies under coordinate number coloring.
(a) Central symmetry coloring (b) coordinate number coloring. (c) Schematic illustration [*tilted view*]

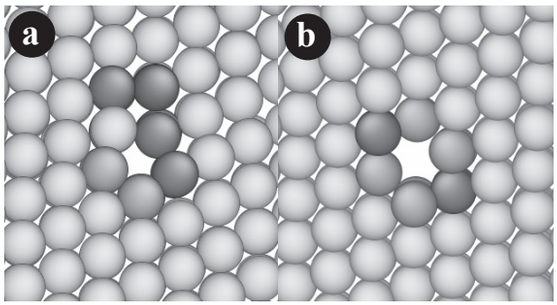


Figure 4: (a) a roll of vacancy type partial point defects. (b) a roll of whole vacancies.

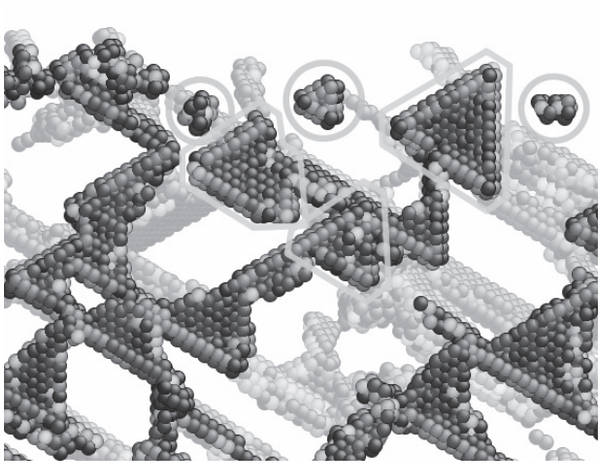


Figure 5: Front view of a dislocation plane (coloured in central symmetry parameter), illustrating a system of triangular stacking fault structures. Majority of these triangular structures are connected with each other at their apex. Some of these structures are closed (circled in orange), forming some completed stacking fault tetrahedrons. Circle in green are some collapsed structures manifested as vacancies.

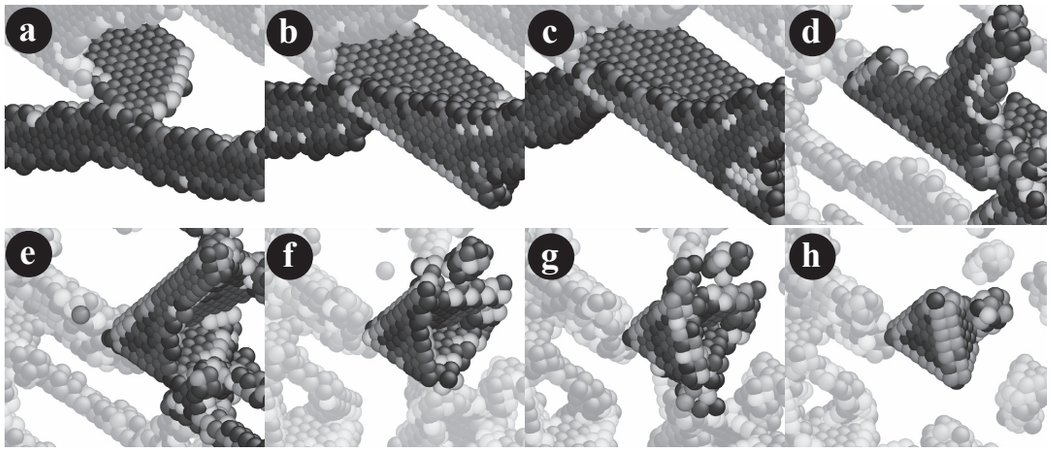


Figure 6: Stacking Fault Tetrahedron formation process

a)Stacking fault disk emerging to an stacking fault ribbon (dissociated edge dislocation). b) Stacking fault disk bisected the ribbon. c) Elastic interaction distorded the shape of the ribbon, expanding the stacking fault on the right while abridging the stacking fault on the left. d) Residue stress and perierl force aligned sections of the partial dislocations with the <110> direction. e) Third stacking fault plate is nucleated from the top. The net structure resembles an opened stacking fault tetrahedron. f) Stacking fault plates recede and have their partials aligned with <110> directions. g) A partial cross-sliped to the δ plane, leaving an Lomer-Cottrell junction on the BC edge. h) The cross-sliped partial closed the structure, forming a closed SFT with some vacancies attached onto its A-apex.

Honours & Awards: The Engineering Institute of Canada

2012 is the 125th anniversary of the Canadian Society for Civil Engineering and also for the Engineering Institute of Canada. The EIC will hold two awards galas in 2012 to recognize outstanding engineers and five outstanding engineering achievements in Canada. The first event was held in Ottawa at the Westin Hotel on February 25. The second event will be held in Edmonton at the Shaw Conference Center on June 7 2012.

Congratulations to the following CSME members, who received the awards in Ottawa.

EIC Fellows

Hossam Kishawy Ph.D. FASME
Full Professor and Director, Mechanical Manufacturing
University of Ontario Institute of Technology
"For contributions to modeling, optimization and design and to university management."

EIC Fellows

Murray John Thomson Ph.D.
Full Professor University of Toronto
"For contributions to alternative fuels, pollutions control and combustion sensors".

EIC Fellows

Georgios Vatistas Ph.D. FCSME
Full Professor and Associate Dean
Concordia University
"For contributions to fluid dynamics modeling vortex dynamics."

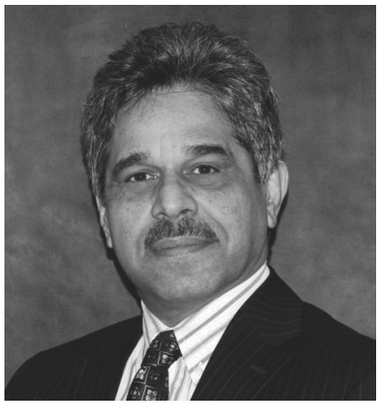
EIC Fellows

Farrokh Sassani Ph.D. FCSME
Full Professor, University of British Columbia
"For contributions to teaching systems modeling, simulation, machine design process automation and fault detection"

EIC Fellows

Dan Zhang Ph.D. FCSME
Full Professor and Canada Research Chair Robotics
University of Ontario Institute of Tehnology
"For contributions to re-configurable robotic systems and development of engineering programs".

Julian C. Smith Medal



Javad Mostagimi Ph.D. FASME FIUPAC
FCSME FIAS FCAE & Massey College
Full Professor and Director, Center for Advanced Coating Technology University of Toronto
"For modeling the solidification of molten droplets on solid surfaces, leading to advances in many industries."

Engineering Institute of Canada
Engineering for a prosperous, safe and sustainable Canada.

L'Institut Canadien des Ingenieurs
Le génie pour un Canada sûr, prospère et durable.

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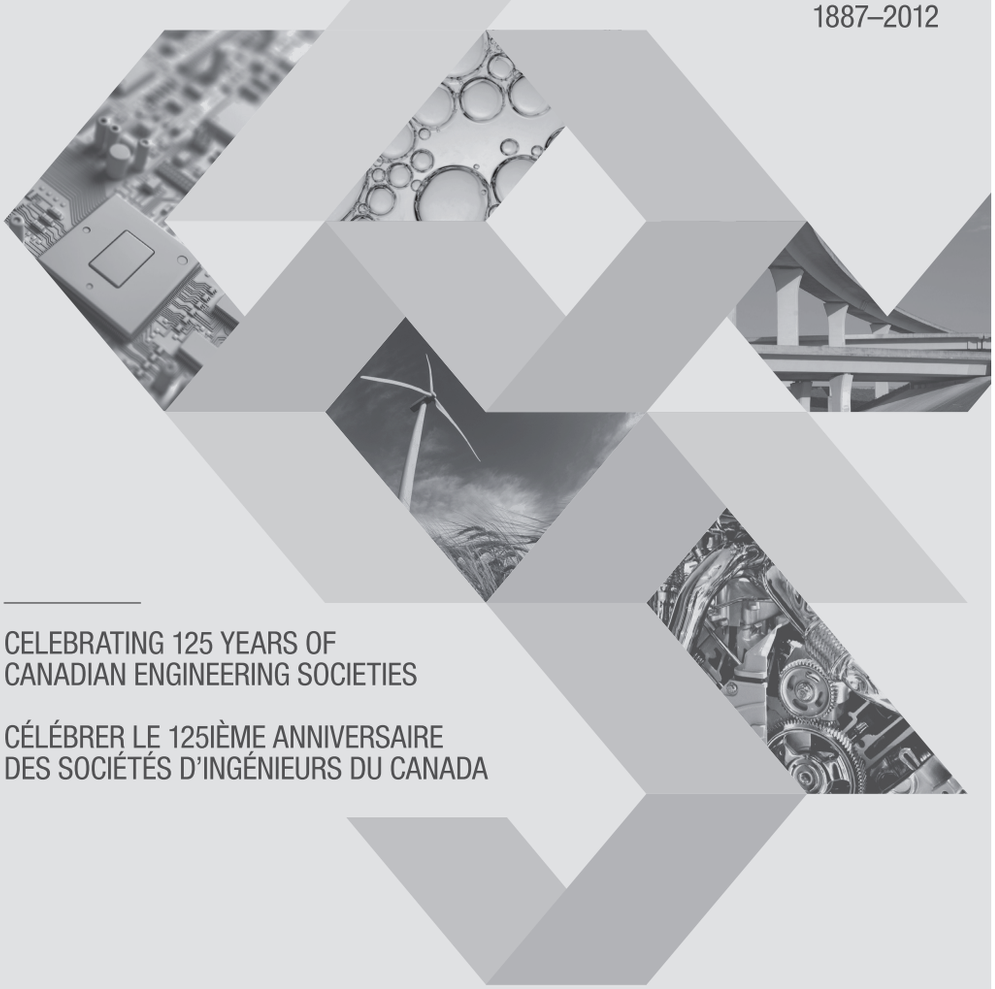

CELEBRATING 125 YEARS OF CANADIAN ENGINEERING SOCIETIES

CÉLÉBRER LE 125IÈME ANNIVERSAIRE DES SOCIÉTÉS D'INGÉNIEURS DU CANADA

MEMBER SOCIETIES / SOCIÉTÉS MEMBRES:

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L'Institut des Ingénieurs Électriciens et Électroniciens

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Canadian Geotechnical Society
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Canadian Society for Engineering Management
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Canadian Medical and Biological Engineering Society
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FOR MORE INFORMATION PLEASE VISIT / POUR PLUS AMPLE INFORMATION VEUILLEZ VISITER: **WWW.EIC-ICI.CA**

TIME TO CELEBRATE
2012 is the EIC's 125th Anniversary

History Synopsis: The EIC was founded as the Canadian Society of Civil Engineers in the context of engineers applying their abilities to non-military applications. The membership was eclectic as far as their field of application was concerned. In 1918 the members practicing what is recognized as Civil Engineering today formed the first member society of the EIC with the title "Canadian Society *for Civil Engineering"* and the parent society received its current name along with a Canadian national charter. Canada's well-known iron ring, The Canadian Academy of Engineering and a model for the incorporation of Canada's Provincial Professional Engineering Associations were all originated in the EIC.

The EIC will mark this achievement with two Awards Galas. The first will be in **Ottawa on 25 February 2012** at the Westin Hotel. The second gala will take place at the Shaw Conference Centre in **Edmonton on 7 June 2012** where we will join the Canadian Society for Civil Engineering in a joint event coincident with their annual meeting.

Because of the special nature of 2012 the EIC will recognize four Canadian companies for their contribution to engineering achievement in Canada: McDonald Detwiller for RADARSAT I & II and CANADARM; TRIUMF; Canada Lands Company CLC Ltd. for the CN Tower and Strait Crossing Bridge for the Confederation Bridge. These companies will become honorary members of the EIC at our gala in Ottawa on 25 February 2012.

So mark your calendars and join us in celebrating 125 years of Engineering Societies in Canada.

The Engineering Institute of Canada (EIC), now a federation of Canadian engineering Societies, was established as Canada's first engineering association in 1887.

In concert with its current 11 member societies, the EIC, recognizes outstanding engineers for their exemplary contributions to Canada and the World by virtue of their engineering achievements and involvement in societal endeavours. These awards are considered the senior ones in the Canadian Engineering Societies Community.

The EIC also promotes engineering as a career, conducts national and international conferences, preserves engineering history and archives, applies internationally recognized standards for continuing engineering education in Canada and participates with the other national engineering bodies in leadership oversight of the discipline.

C'est le temps de célébrer
2012 est le 125ième anniversaire de l'ICI

Bref historique: À ses débuts, dans le contexte d'ingénieurs mettant à profit leurs compétences dans des applications non militaires, l'ICI porte le nom de Société canadienne de génie civil. Ses membres sont variés, en fonction des domaines d'applications. En 1918, les membres pratiquants que l'on identifie maintenant comme le génie civil, forment la première société membre de l'ICI. Elle porte le nom de Société canadienne de génie civil. La société mère reçoit le nom actuel et la Charte nationale canadienne. Le fort reconnu anneau de fer des ingénieurs, l'Académie canadienne de génie et le modèle pour l'incorporation des associations professionnelles provinciales canadiennes de génie proviennent tous de l'ICI.

L'ICI tient à marquer ce success en organisant deux galas. Le premier aura lieu à Ottawa le 25 février 2012 au Westin Hotel. Le second gala aura lieu à l'occasion de la réunion annuelle de la « Canadian Society for Civil Engineering » à Shaw Conference Centre Edmonton le 7 juin 2012.

2012 étant une année exceptionnelle, ICI récompensera quatre entreprises canadiennes pour leurs contributions-dans le domaine de l'ingénierie au Canada : McDonald Detwiller for RADARSAT I & II and CANADARM; TRIUMF; Canada Lands Company CLC Ltd. pour la tour du CN et le Strait Crossing Bridge pour le Pont de la Confédération. Ces entreprises seront désignées comme membres honoraires du ICI lors du gala à Ottawa le 25 fevrier 2012.

Veuillez prendre note de ces évènements, et venez nous rejoindre nombreux pour fêter les 125 années des Sociétés d'Ingénieurs du Canada !

L'institut canadien des ingénieurs (ICI), aujourd'hui une fédération des associations canadiennes du génie, a été établi en 1887 faisant d'elle la première dans le domaine.

De concert avec ses 11 sociétés membres, l'ICI reconnaît les contributions exemplaires d'ingénieurs s'étant démarqués par leurs réalisations en ingénierie et leur implication dans la société tant au Canada que dans le monde. Ces prix sont considérés comme prix séniors dans la communauté des Sociétés canadiennes d'ingénierie.

L'ICI promuvoit aussi le génie comme carrière, organise des conférences nationales et internationales, préserve l'histoire et les archives du génie, applique les normes internationales reconnues en formation professionnelle au Canada et participe, de concert avec d'autres entités nationales en ingénierie, au suivi du leadership dans le domaine.

Contact louisem@cogeco.ca or 613 547 5989 for reservations.

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