

RESEAU FRANÇAIS DE MECANOSYNTHESE

Lettre N°45

Décembre 1998

130 Groupes de Recherche
(dont 66 à l'étranger)

Bureau : E. Gaffet (Président), G. Le Caër (Secrétaire Général), A.R. Yavari (Trésorier)

2 Nouvelles Adhésions :

P. Balaz - Institute of GeoTechnics - Kosice - Slovaquie
To Ba Van - Institute of Materials Science - Vietnam

A l'initiative de la Société Française de Métallurgie et de Matériaux, se tiendra le 23 Novembre 1998, une réunion des Présidents des différentes Sociétés Savantes Françaises pour l'ordre du jour suivant :

Tour de Table, - Présentation Rapide, Articulation des Sociétés, Volet Européen, Publications, Coopérations Possibles, Avenir de la Métallurgie en France -

Présentation de l'enquête (pourquoi, comment) - questions diverses.

Si l'un (e) d'entre vous a des suggestions ou des éléments de réflexion à fournir, prière de le faire rapidement auprès d'E. Gaffet.

Les éléments de cette réunion figureront dans l'une des prochaines lettres du RFM.

Les différentes propositions recues pour la conférence ISMANAM98 sont désormais en ligne sur le site web de la conférence :

<http://www.uow.edu.au/conferences/ismanam98>

!!!!

Le site web du RFM est le suivant

<http://www.bls.fr/amatech>

Rubrique Pages Sciences et Techniques pour l'Ingénieur (Rubrique Sciences)

⇒ vous y trouverez les anciennes lettres du RFM (accessible par Adobe Acrobat)

les statuts du RFM ainsi que les annonces concernant les JRFM'99 et quelques éléments mis à jour régulièrement concernant les derniers résultats dans ce domaine.

Une Rubrique "Forum"

est ouvert sur le site web du RFM afin de permettre de discuter sur tout sujet

"Mécanosynthèse et/ou Nanomatériaux"

L'inscription en ligne aux JRFM'99 est possible sur ce site Web !!!!

=====

JRFM'99

4 èmes Journées du Réseau Français de Mécanosynthèse
Dijon, les 2-3 Juin 1999
1ère circulaire

Programme des JRFM'99

- 3 conférenciers invités sont d'ores et déjà programmés :
- D.LOUER (Directeur de Recherches CNRS- Rennes).
 - JF.BERAR (Ingénieur de Recherches CNRS- Grenoble / ESRF).
 - J.C.MUTIN (Directeur de Recherches CNRS - Dijon).

Appel à Communications
à renvoyer avant le **30 Décembre 1998**

Nom:Prénom:

Adresse:.....

.....

Téléphone : Fax :E-mail :

Souhaite présenter une communication lors des JRFM99 sous forme de :
communication orale Communication par affiche

Titre :

Fiche d'inscription à retourner à

Frédéric BERNARD (Journées RFM99), Laboratoire de Recherches sur la Réactivité des Solides (UMR5613 CNRS - Université de Bourgogne), 9 avenue Alain Savary, BP 400, 21011 Dijon Cedex. (Tel : 03.80.39.61.25 - fax : 03.80.39.61.67, E-mail : fbernard@u-bourgogne.fr)

Comité d'organisation :

Frédéric Bernard et toute l'équipe " Matériaux à Grains Fins " :
Laboratoire de Recherches sur la Réactivité des Solides (UMR5613 CNRS
Université de Bourgogne), 9 avenue Alain Savary, BP 400, 21011 Dijon Cedex.
Tel : 03.80.39.61.25 - Fax : 03.80.39.61.67, E-mail : fbernard@u-bourgogne.fr)

Eric Gaffet :

Président du Réseau Français de Mécanosynthèse
Groupe "Nanomatériaux" - CNRS UPRA423/806 - Institut Polytechnique de Sévenans
90100 Belfort Cedex.
Tél : 03 84 58 31 02 - Fax : 03 84 58 30 27 - E-mail : Eric.Gaffet@utbm.fr

=====

**ANNONCE DE CONGRES ET / OU ECOLES
CONGRESS AND SCHOOL ANNOUNCEMENTS**

=====

All the details may be obtained by E-Mail to E. Gaffet

ISMANAM98

International Symposium on Metastable, Mechanically Alloyed and Nanocrystalline Materials
Wollongong (Sydney) - Australie - 7 - 12 Décembre 1998

International Advisory Committee :

V.V. Boldyrev, R.W. Cahn, S. Enzo, H. Fecht, E. Gaffet, A. Garcia - Escorial, A.L. Greer, E.Y. Gutmanas,
K. Lu, M. Mammoun, M.T. Mora, H. Mori, M.A. Morris, L. Schultz, M. Senna, A. Slawska - Waniewska,
R. Schwarz, R.W. Siegel, M. Umemoto

ISMANAM Steering Committee :

J.H. Ahn, M.D. Baro, A. Calka, S. Gialanella, A. Inoue, G. Le Caer, D.G. Morris, P.H. Shingu, H. Bakker,
R. Bormann, G. Cocco, A. Hernando, C.C Koch, M. Magini, R. Schulz, A.R. Yavari

Contact : A. Calka E-Mail : Andrzej_Calka@uow.edu.au et

WebSite : <http://www.uow.edu.au/conferences/ismanam98>

**Satellite Symposium on Mechanochemistry / ISMANAM98
(Mechanochemical Synthesis and Mechanochemistry)**

Wollongong - Australie 7 /12 Decembre 1998

International Advisory Committee :

E. Ivanov (Chairman), A. Calka, V. Bodyrev, P. Butyagin,
E. Gaffet, E. Gutman, M. Senna, C. Suryanaryana, R. Schwarz

WebSite : <http://www.uow.edu.au/conferences/ismanam98>

Etat de l'Art en Mélange de Solides

Toulouse (ENSIGC) - 11 Décembre 1998

Org. : Société Française de Génie des Procédés.

Contacts : Martine.Poux@ENSIGCT.fr

Pierre.Guigon@utc.fr

NOUVEAU

Nanostructured Hybrid Materials

Symposium TMS Annual Meeting - San Diego CA - USA - 28 Février 4 Mars 1999

Contact : gmchow@anvil.nrl.navy.mil

XXV JEEP

Journées d'Etudes des Equilibres entre Phases 1999

11 - 12 Mars 1999 - Annecy France

E-Mail : Conference.Jeep@univ-savoie.fr

VII International Seminary

Defects, structure and properties of Nanocrystalline Materials obtained by Nanocrystallization of Amorphous Solids
and of Metals with Extreme Distortion of the Lattice

Mars 1999 - Ekaterinburg - Russie

E-Mail : Noskovaimp.uran.ru

Nanocomposite Materials : Design and Applications

28 Mars - 2 Avril 1999 - Alyeska Resort - Alaska

E-Mail : Engfnd@aol.com

4th International Workshop on Metastable Phases (IV IWOMP)

7 - 9 Avril 1999 - Bologne - Italie

Contact : Bonetti@df.unibo.it

12th International Conference on Wear of Materials

Atlanta - Georgie / USA - 25 - 29 Avril 1999

contact : Amy Richardson E-Mail A.Richardson@elsevier.co.uk

or web site : <http://www.elsevier.nl/locate/wom99>

E_MRS - Spring Meeting

1 - 4 Juin 1999 - Strasbourg - France

Web Site <http://www-emrs.C-strasbourg.fr>

Symposium A : Phot - Excited Process and Applications

Symposium B : Protective Coating and Thin Films 99

Symposium C : Progress in Computational Materials Science

Symposium D : Plasma and Ion Surface Engineering

Symposium E : Advanced Silicon Substrates

Symposium F : Process induced defects in Semiconductors

Symposium G : Material Physics Issue and Applications on Magnetic Oxides

Symposium H : Strain in Materials : Analysis, Relaxation and Properties

Symposium I : Microcrystalline and Nanocrystalline Semiconductors
Symposium J : Materials for Coherent Optics
Symposium K : Materials, Process and Technology for Optical Interconnect
Symposium L : Ab - Initio Approaches to Microelectronics Materials...
Symposium M Basic Models to enhance Reliability in Si based devices and ..
Symposium N : Molecular Optoelectronics : Materials, Physics and Devices
Symposium O : Chalcogenide Semiconductors for Photovoltaics
Symposium P : Optical Characterization of Semiconductor layers and Surfaces

JRFM'99

4èmes Journées du RFM
2 & 3 Juin 1999 - Dijon - France
Web Site : <http://www.bls.fr/amatech> - Web SubSite : Sciences

**Nanostructured Materials Symposium at the 5th IUMRS International Conference
on Advanced Materials
(IUMRS - ICAM'99)**

Beijing - Chine - 13 - 18 Juin 1999
Contact : Kelu@imr.ac.cn
WebSite - <http://www.chimeb.edu.cn>

PM2 Tec 98

1999 International Conference
on Powder Metallurgy and Particulate Materials
Vancouver - 20 / 24 Juin 1999
E-Mail : Info@mpif.org - Website: www.mpi.org

4th Int. Conf. on Materials Chemistry

13 - 16 Juillet 1999 - Trinity College _ Univ. Dublin - Irlande
Web Site : <http://www.rsc.org/conferences>

Themes :

Inorganic Nano and Micro Particles
Functional Polymers
Magnetic Materials
Organic Nanostructures
Molecular Crystals and Crystal Engineering
Computational Chemistry and Materials for Electronic

Advanced Materials - Nanostructured Systems

15 - 17 Juilllet 1999 - Hong Kong
1st workshop of the new IUPAC series :

"New Directions in Chemistry
Theory, Nanoparticles, Quantum Dots,
Bio - Inspired Structures, Applications to Nanotechnology
Organizing Committee A. El - Sayed - Georgia Tech - Atlanta - USA
J. Portner - President of IUPAC - Tel Aviv - Israel
N. Teng Yu - HKUST - Hong Kong
S. Williams - Hewlett - Packard Co., California USA

Web Site : <http://www.iupac.org/symposia/conferences/wam1>

NATO Advanced Research Workshop

Investigations and Applications of Severe Plastic Deformation
2 - 6 Aout 1999 - Moscou - Russie
E-Mail : TLowe@lanl.gov and Valiev@ippm.rb.ru

10th International Conference on Rapidly Quenched and Metastable Materials (RQ10)

Bangalore - Inde - 23 - 27 Août 1999
Wesite : <http://www.metalrg.iisc.ernet.in/rqten/>

SMM14

**14th International Conf. on Soft Magnetic Materials
8 - 10 Septembre 1999 Balatonfüred - Hongrie
web site : <http://www.kfki.hu> - Subsite : [smm14](http://www.kfki.hu)**

Int. Symp. Cluster and Nanostructure Interfaces (ISCANI)

25 - 29 Octobre 1999 - Richmond USA
website : <http://www.vcu.edu/ISCANI/>
=====

Annonces de Soutenance de Thèses
=====

**Caractérisation et réactivité de la surface de poudres nanométriques d'oxydes métalliques:
Analyse par spectrométrie IR-TF et application à l'étude des mécanismes de détection de gaz
par capteurs résistifs.**

Jérôme Tribout - Université de Limoges, Limoges, France, 14 décembre 1998.

Directrice: Marie-Isabelle Baraton

=====
Distinct Element Modelling of a Planetary Ball Mill

M.P. Dallimore - Dpt of Mechanical and Materials Engineering - University Western Australia - Australie

The distinct element method of modelling has been used to develop a model of a laboratory scale planetary ball mill. The model has been used to evaluate variations in processing parameters such as the impact frequency and energy associated with different milling configurations. These results have been compared to the kinetics of the Ni/CuO displacement reaction propagated under these conditions.

The model is two dimensional in nature and incorporates a modified Kelvin viscoelastic spring / damper system to describe the impact process using experimentally derived impact parameters. The simulation enables quantitative analysis of the collision energies and their spatial distribution. Validation of the model was achieved through the use of high speed video analysis of actual ball trajectories.

The results of the modelling study have demonstrated that kinematic considerations alone are insufficient to predict the variation in ball motion and energy dissipation that occur for different mill configurations. The amount of slip between the balls and the vial wall plays a significant role in determining both the tumbling trajectories and the level and mode of energy dissipation.

When comparing the model predictions to the experimental milling results, it was found that reaction rate was particularly sensitive to the spatial distribution of the impacts. Only when the tumbling trajectories remained relatively unchanged, could the reaction rate be tied to the total level of energy dissipated. Both the energy dissipated through impacts and attrition play an important role in promoting the reaction. The results suggest that the spatial distribution of the impact energy must be considered with respect to the distribution of powder within the vial to fully explain the variations in reaction rates.

=====
Synthèse et Propriétés de Ferrites Nanométriques : Influence de l'énergie de surface sur les propriétés structurales et magnétiques de ferrites de titane synthétisés par chimie douce et mécanosynthèse

N. Guigue - Millot - 26 Novembre 1998 - LRRS UMR 5613 CNRS - Univ. Bourgogne - Dijon - France

Jury : J. Etourneau, A. Rousset, G. Bertrand, D. Stuerger, G. Le Caër, M. Guyot, O. Isnard, P. Perriat

Ce travail porte sur l'influence de l'énergie de surface sur les propriétés des matériaux. Pour réaliser cette étude, la première étape incontournable devait être la recherche d'un matériau modèle. Les ferrites nanométriques sont apparus comme de bons candidats : l'accent a été mis sur la maîtrise à la fois de la taille et de la stoechiométrie des grains de poudre. Le cas particulier des ferrites de titane $Fe_{3-x}Ti_xO_4$ est développé : c'est le ferrite de titane $(Fe_{2.5}Ti_{0.5})_{1-x}O_4$ qui est le meilleur candidat pour cette étude. Pour ce composé et pour des tailles de grains d'une quinzaine de nanomètres, on peut faire varier x de 0 à x_{max} tout en restant en phase spinelle. Nous avons développé deux méthodes de synthèse : la chimie douce et le broyage à haute énergie. Ces deux modes de préparation conduisent à des grains d'une quinzaine de nanomètres, cependant, les nanostructures obtenues dans les deux cas sont très différentes. Ainsi, la poudre obtenue par mécanosynthèse se présente sous la forme d'agrégats composés de cristallites de distribution granulométrique large centrée autour de 12 nm alors que la poudre obtenue par chimie douce est finement divisée avec des grains de taille homogène égale à 18 nm. C'est la chimie douce qui est le mode de préparation de poudres nanométriques le plus adapté à l'étude de phénomènes de surface car l'état d'agrégation des poudres broyées, leur taux de défauts important, leur distribution granulométrique large et le fait que la phase formée soit métastable dans les conditions normales du fait d'une inversion cationique induite par le broyage, font de ces poudres de mauvais candidats pour notre étude fondamentale.

Par des techniques d'analyse locales et statistiques des hétérogénéités au sein des grains de poudre lors de leur étude à l'air ont été mises en évidence. Leur origine est cinétique et découle d'une oxydation incomplète des cations Fe^{2+} sous l'effet des contraintes existant au sein même des grains. La solution pour étudier ces matériaux à l'équilibre consiste alors en la mise en place d'outils de caractérisation in situ : un dispositif de régulation de faibles pO_2 a ainsi été couplé à des expériences de thermogravimétrie, de diffraction des rayons X et de conductivité. Pour éviter cette ségrégation une autre astuce consiste à étudier des matériaux stables dans les conditions normales : les matériaux $(Fe_{3-x}Ti_x)_{1-x}O_4$ ne contenant que des cation fer à la valence 3.

L'énergie de surface qui permet de stabiliser des phases hautement symétriques en dehors des limites habituelles et des solutions solides immiscibles pour les gros grains n'influe par contre pas sur la distribution cationique et lacunaire des ferrites. L'étude de la transition de Verwey a d'autre part permis de confirmer le caractère granulo-dépendant des transitions de phase. Un décalage de la température de cette transition est en effet observé lorsqu'on diminue la taille des grains de Fe_3O_4 . Enfin, l'étude de cette transition pour des poudres nanométriques hautement non-stoechiométriques a permis de montrer que l'origine de cette transition est purement structurale et que le paramètre pertinent est le nombre de paires Fe^{2+}/Fe^{3+} en sites B. En outre, l'utilisation du SQUID et de mesures ZFC permet une investigation plus fine de cette transition pour laquelle l'arrangement des cations Fe^{2+} et Fe^{3+} en dessous de la température de transition ne se fait plus qu'à courte distance et n'est donc détectable que par des mesures sensibles à quelques voisins seulement.

=====
Transformations antiferromag - ferromag - paramagnétiques - verre de spin dans les alliages de Fe Rh nanocristallisés par Broyage

E. Navarro - Université de Complutense - Madrid - Espagne - 18 Mai 1998

Co directeurs : A. Hernando - A.R. Yavari

=====
Modifications morphologiques et microstructurales du matériau actif des cathodes de batteries à l'ion lithium

induites par broyage et traitement thermique

Ph. Perrot - Université de Poitiers - 6 Mai 1998

Co - Directeurs : E.L. Mathe, M. Grosbras

Jury : J. Mimault, H. Van Damme, A. Dauger, M. Broussely, P. Goudeau, E.L. Mathe, M. Grosbras

=====
Effects of the mechanical milling on carbons : negative electrode materials of Li - ion batteries"

F. Salver Disma - Université de Picardie Jules Verne - 4 Février 98

Jury : Aymard L., Beguin F., Coulon M., Furdin G., Lassegues JC, Percheron Guegan A., Rouzaud JN, Tarascon JM.

=====
"Elaboration et Caractérisations de Cermets Alumine - Métal à partir de poudres obtenues par Mécanosynthèse"

J.-L. Guichard - INPL - Nancy - 23 Janvier 1998

Jury : A. Simon, C. Carry, F. Thévenot, G. Le Caër, A. Mocellin

=====
"Spinelles nanométriques à valence mixte et à fort taux de lacunes cationiques : Transfert électroniques dans un ferrite de molybdène $Fe_{2.47}Mo_{0.53}O_4$, de la synthèse aux propriétés magnétiques dans le système fer - vanadium $Fe_{3-x}V_xO_4$ ($0 < x < 2$).

V. Nivoix - Université de Bourgogne - 17 Décembre 1997

Jury : M. Lenglet, H. Pascard, G. Bertrand, E. Gaffet, M. Guyot, M. Lallemand, A. Rousset, B. Gillot

=====
"The Preparation of Nitrides and Carbides by Mechanical Treatment - Phases and Structures"

G.M. Wang - School of Physics, University College, The University of New South Wales - Australian Defence Force Academy - Canberra, ACT 2600 - Australia - 10/12/97

Supervisor - S.J. Campbell - **Co - Supervisors** : W.A. Kaczmarek and A. Calka

=====
"Suivi par Diffraction X en Temps Réel de la Formation par Combustion des intermétalliques des systèmes Al - Ni, Al - Ti, Al - Ni - Ti"

J. F. Javel - Université de Nancy I - 3 Octobre 1997

Jury : J.F. Berar, F. Bernard, M. Bessiere, M. Dirand, J.C. Gachon, P. Galez, J.C. Jorda

=====
"Contribution à l'Etude de la Transformation - Tribologique Superficielle en Fretting"

E. Sauger - Ecole Centrale de Lyon - Génie des Matériaux - 26 Septembre 1997

Jury : L. Mora - Ponsonnet, P. Blanchard, K. Dang Van, C. Esnouf, E. Gaffet, E. Rosset, A.B. Vannes, L. Vincent

=====
Sites internet à découvrir

Site sur la cristallographie / Soft + Littérature

<http://www.lmcp.jussieu/sincris-top/logiciel>

N.B. : si vous connaissez d'autres sites en relation avec les thèmes développés par le RFM, faites nous les connaître

Post Doc Position Proposals

Brésil

Post doc to work in electron microscopy characterization of nano - structured materials.
Contact : Walter J. Botta. F. - Federal Univeristy o Sao Carlos - Sao Paulo State - Brésil
Adresse : DEMa - UFSCar - CP 676, 13565 - 905 Sao Carlos SP Brésil.
tél : 016 - 2608251 - Fax : 016 2615404.

Belgique

The Department Metallurgy and Materials Engineering (MTM) of the K.U.Leuven (Belgium) has a research position available. Candidates are asked to contact the responsible staff member.

Area of research :

Metals and Alloys, Polymer Matrix Composites, Intelligent Processing of Materials, Surface Engineering and Tribology, Metal Forming and Mechanical Behaviour of Materials, Quality Control and Non-Destructive Testing of Materials, Ceramics, Thermodynamics, Corrosion, Nuclear Engineering

Description of research task

Tailor made powders by mechanical alloying of Fe and Cu based materials. Application field: specific composite materials, to be prepared by conventional PM consolidation techniques. Research activities: parametric study of MA, alloy design, microscopic

Staff member to be contacted

Prof. Dr. Ir. L. Froyen

Katholieke Universiteit Leuven - Dept. MTM

de Croylaan 2 - B-3001 Leuven (Belgium)

Tel. +32/16/22.09.31

Japon

Our group: Nanocomposite Group, Department of Composite Materials, National Institute of Materials and Chemical Research, Tsukuba, Ibaraki, Japan is now looking for post-doc researchers

The candidates would be integrated in the Nanocomposite Group of the Department of Composite Materials. The research interests of the group are mainly focused on nanocomposite preparation and its optical/chemical functionalities. Research projects currently under way aim to develop nanostructured and optically/chemically active thin films by sputtering, laser ablation and so on. For additional information about the Institute and group :

<http://www.nimc.go.jp/>

<http://www.aist.go.jp/NIMC/fcg/index.html>

Experience in the fields of materials science (ceramic or metal) is required.

There are two types of post-doc positions.

1. Long-term: from 6 months to 2 years

2. Short-term: from 1 to 3 months

If you or someone in your laboratory is intersted in this fellowship, please contact as soon as possible to:

Dr. Naoto Koshizaki - Department of Composite Materials

National Institute of Materials and Chemical Research(NIMC) 1-1 Higashi, Tsukuba, Ibaraki 305-8565 JAPAN

Tel: +81-298-54-6335 - Fax: +81-298-54-6252 - E-mail: koshizaki@nimc.go.jp - <http://www.aist.go.jp/NIMC/fcg/index.html>

Bibliographie Récente

Livres ou "Special Issues"

Surface-Controlled Nanoscale Materials for High-Added-Value Applications.

Editors: Kenneth E. Gonsalves, Marie-Isabelle Baraton, Rajiv Singh, Heinrich Hofmann, Jerry X. Chen, and Joseph A. Akkara.

Materials Research Society, Symposium Proceedings Volume 501, 1998

MRS, Warrendale, Pennsylvania, USA (website: <http://www.mrs.org/>)

"Nanomatériaux"

Editeur : Innovation 128 - 24 Rue du Quatre Septembre 75002 Paris - France

Les dernières années ont vu apparaître dans le monde des matériaux avancés le préfixe "nano" (nanostructuré, nanocristallins, nanophase ou nanométrique) ; les conférences et les forums sur Internet se multiplient où s'échangent des informations sur les avancées scientifiques et technologiques dans ce domaine des matériaux nanostructurés qui se distinguent des matériaux polycristallins conventionnels par la dimension des cristallites les composant ou par la dimension des hétérostructures présentes : ces dimensions sont de quelques dizaines d'angströms, voire de quelques nanomètres. A ces dimensions, les propriétés des matériaux changent radicalement.

Au début des années 90, les japonais ont été les premiers à lancé d'ambitieux programmes de R & D puisque le MITI a consacré aux nanomatériaux près de 200 millions de dollars pour la période 1990 - 2000 et que la Science & Technology Foundation a investi presque la même somme pour co - financer des projets de laboratoires publics et privés. Les Etats Unis puis les pays européens ont investi plus tardivement mais déjà ont obtenu des résultats prometteurs (.....) Certaines applications existent déjà au niveau international, quelque 400 sociétés se partagent aujourd'hui un marché voisin de 1 milliard de dollars mais qui devrait tripler, voire quintupler à l'horizon 2001.(.....)

(...) Pour aider les industriels concernés à imaginer les applications qu'ils pourraient s'approprier et identifier les acteurs internationaux, la présente étude dresse un état de l'art complet des nanomatériaux en décrivant leurs procédés d'élaboration actuels ou envisagés et en détaillant leurs différentes propriétés physico - chimiques et les géométries que l'on peut obtenir.

Enfin l'étude permet de cerner les applications actuelles et potentielles...

CHEMISTRY FOR SUSTAINABLE DEVELOPMENT

Vol. 6, No. 2-3, MARCH-JUNE 1998

Proceedings of 2d International Conference on Mechanochemistry

(INCOME-2), which was held in Novosibirsk in 1997.

Contact : Prof. • N.Z. Lyakhov, Inst. Sol. State Chem.- Russian Acad Sci. - Kutaleladze, 18 - Novosibirsk - 630128 Russia - The Proceedings will be available by the price 80 USD.

Mechanochemistry of Materials Cambridge International Science Publishing

Emmanuel Gutman - Materials Eng. Dpt - Ben Gurion University - Beer Sheva - Israel

Considerable advances have been made in mechanochemistry in the last couple of decades. Training of experts in this field with a background in materials science, chemical and mechanical engineering, etc. requires study of the fundamentals of mechanochemistry. There is a need for a textbook in the general and compressed form which would cover many aspects and would be used as a basis for understanding the fundamental principles to control mechanochemical phenomena. This textbook is based on lectures given by Prof. Gutman in a graduate course in the mechanochemistry of materials at the Ben - Gurion University of the Negev. The book contains examples of experimental results to illustrate the mechanochemical phenomena and technologies.

BIBLIOGRAPHY ON MECHANICAL ALLOYING AND MILLING

Suryanarayana (Inst for Materials and Advanced Processes, University of Idaho, USA)

The present bibliography covers information on mechanical alloying and milling of materials starting from 1970 (when it was recognized that MA has become a commercial/viable material processing technique instead of just a grinding method) to 1996. All the available references will be presented in a chronological fashion. Under each year, (.....)

Please send your order to: Book Department - Cambridge International Science Publishing 7 Meadow Walk, Great Abington, Cambridge CB1 6AZ, England Fax: +44 1223 894 539; tel +44 1223 893295, email: orders@cispc.demon.co.uk / Cambridge International Science Publishing <http://www.demon.co.uk/cambsci/homepage.htm>

Proceeding du Congrès "Mechanically Alloyed, Metastable and Nanocrystalline Materials"- Barcelone (1997)

Editor : M.D. Baro, S. Surinach - Materials Science Forum 269 - 272 (1998)

JOURNAL OF NANOPARTICLE RESEARCH (ISSN 13-88-0764)

<http://www.wkap.nl/journals/nano>

AIMS AND SCOPE:

The objective of the Journal of Nanoparticle Research is to disseminate knowledge of the physical, chemical and biological phenomena and processes in structures that have at least one lengthscale ranging from molecular to approximately 100 nm (or submicron in some situations), and exhibit improved and novel properties that are a direct result of their small size. The focus of the Journal is on the specific concepts, properties, phenomena, and processes related to particles, tubes, layers, macromolecules, clusters and other finite structures of the nanoscale size range. Synthesis, assembly, transport, reactivity, and stability of such structures are considered. Development of in-situ and ex-situ instrumentations for characterization of nanoparticles and their interfaces should be based on new principles for probing properties and phenomena not well understood at the nanometer scale. Modeling and simulation may include atom-based quantum mechanics; molecular dynamics; single-particle; multi-body and continuum based models; fractals; other methods suitable for modelling particle synthesis, assembling and interaction processes. Realization and application of systems, structures and devices with novel functions obtained via precursor nanoparticles is emphasized. Approaches may include gas-, liquid-, solid-, and vacuum-based processes, size reduction, chemical- and bio-self ananoparticle systems and nanocomponents in larger systems. - Fundamental physical (mechanical, thermal, optical, etc.), chemical and biological characterization of nanoparticles and their interfaces, and development of in-situ and ex-situ instrumentation based on new principles for probing properties and phenomena not well understood at the nanometer scale.

- Synthesis and processing of nanoparticles and related nanoprecursor structures: clusters, aerosol and colloid particles, nanotubes, nanolayers, biological structures, self-assembled systems. Approaches may include gas-, liquid-, solid-, and vacuum-based processes, size reduction, chemical- and bio-self assembly.

- Modeling and simulation: atom-based quantum mechanics; molecular dynamics; single-particle, multi-body and continuum based models; fractals; other methods suitable for modeling particle synthesis, assembling and interaction processes.

- Utilization of nanoparticle systems for enhancing a phenomenon or process, such as chemical reactions, nano-electronics and nano-ionics, magnetic processes, optical processes, heat transfer, bio- and chemical reactivity, and bioseparation.

- Utilization of nanoparticles for assembling into one to three dimensional hierarchical structures, including functional nanostructures in dispersions, structural materials, filtration, electronic devices, etc., with a focus on the molecular and multi-particle interactions versus bulk behavior of nanostructured materials.

- Utilization of nanoparticles for the formulation and the administration of drugs, including the use of those systems in the field of the gene therapy or for the transport of molecules arising from biotechnologies (peptides or proteins), and the use of nanoparticles in the field of the diagnosis.

JOURNAL EDITORIAL BOARD

Editor-in-Chief:

Mihail C. Roco, National Science Foundation, Arlington, VA, USA

Editors:

Ronald Andres, Purdue University, West Lafayette, IN, USA

Hiroshi Komiyama, University of Tokyo, Japan

Joop Schoonman, Delft University of Technology, The Netherlands

Associate Editors:

Patrick Couvreur, University of Paris-Sud, France

Toyoki Kunitake, Kyushu University, Fukuoka, Japan

Jan Marijnissen, Delft University of Technology, The Netherlands

John Mendel, Eastman Kodak, Rochester, NY, USA

Gernot S. Pomrenke, DARPA/ETO, Arlington, VA, USA

Sotiris Pratsinis, University of Cincinnati, OH, USA

David Y.H. Pui, University of Minnesota, Minneapolis, USA

Elena F. Sheka, Russian Peoples Friendship University, Moscow, Russia

Robert Tampe, Max-Planck-Institute for Biochemistry, Martinsried, Germany

Editorial Advisory Board:

A. Paul Alivisatos, University of California and Lawrence Berkeley Laboratory, Berkeley, USA

Rose Amal, University of New South Wales, Sydney, Australia

Chunli Bai, Chinese Academy of Science, Beijing, PR of China

Marie-Isabelle Baraton, University of Limoges, France

Lisa Brannon-Peppas, Biogel Technology, Inc., Indianapolis, IN, USA

Brian J. Briscoe, Imperial College, London, UK

Gan-Moog Chow, Naval Research Laboratory, Washington, DC, USA

Yongze Hu, Central Iron and Steel Research Institute, Beijing, PR of China

Dieter Kerner, Degussa Corporation, Ridgefield Park, NJ, USA

Raj Rajagopalan, University of Florida, Gainesville, FL, USA

Robert D. Shull, National Institute of Standards and Technology, Gaithersburg, MD, USA

Stephen G. Sligar, University of Illinois, Mathews, USA
Christopher Sorensen, Kansas State University, Manhattan, USA
David Tirrell, University of Massachusetts, Amherst, USA
Stanley Williams, Hewlett Packard Company and University of California, Los Angeles, USA
Boris I. Yacobson, North Carolina State University, Raleigh, USA
Jackie Ying, Massachusetts Institute of Technology, Cambridge, USA

GUIDE TO AUTHORS

Submission of Manuscripts

For the purpose of refereeing, papers for publication should be submitted initially as hard copies (fourfold) to Kluwer Academic Publishers, Journals Editorial Office, Journal of Nanoparticle Research, P.O. Box 990, 3300 AZ Dordrecht, The Netherlands. The eventual supply of accepted-for-publication. Contributions include utilization of nanoparticle systems for enhancing a phenomenon or process and particle assembling into high hierarchical structures, as well as formulation and the administration of drugs. Synergistic approaches originating from different disciplines and technologies, and interaction between the research providers and users in this field, are promoted. The content of the Journal is at the intersection of various scientific and technological areas, including particle technology, colloids, aerosols, multiphase systems, solid state physics, chemistry and macromolecular science, materials engineering, pharmacy, microcontamination, emission control, environment and health effects, biotechnology and biomedicine, nanosensors and nanoelectronics.

The Journal aims to promote the dissemination of original scientific concepts, interdisciplinary research, manufacturing techniques and novel applications in several areas:

- The unique size dependent properties, phenomena, and processes of cation papers in their final form on MS-DOS or Apple Macintosh diskettes in one of the major word-processing formats (including LaTeX), together with a duplicate hard copy version, will help expedite publication. A LaTeX style file can be obtained from the Publishers (postal address: P.O. Box 990, 3300 AZ Dordrecht, The Netherlands, attention of Editorial Department, Fax (31)-78-639-2555, E-mail address: EDITDEPT@WKAP.NL). A guide to the the Kluwer LaTeX style file is also available on paper and electronic form.

Manuscripts should be written in English, including abstract and up to 6 keywords. In both the text and the references to the literature, the name-and-year system should be used. The references should be arranged alphabetically. Contributors are encouraged to submit a photo or illustration to be considered for publication on the cover page.

The journal will publish:

- Original full scientific papers (about 70% of its contents)
- Brief letters to the editor for timely dissemination of scientific breakthroughs (in the section on "Brief Communications" that will cover about 15% of its contents)
- Brief technical statements on novel technologies and applications (in the section on "Technology and Applications" that will cover about 15% of its contents).

Kluwer Academic Publishers Online

Visit the Kluwer website at <http://www.wkap.nl>

Offprints

Fifty offprint copies of each article will be provided free of charge. Additional offprints can be ordered when proof are returned to the publisher.

No page charges are levied on authors or their institution.

Microfilm and microfiche editions of this journal are available from the University Microfilms International, 300 North Zeeb Road, Ann Arbor, MI 48106, U.S.A.

You are cordially invited to submit articles to Journal of Nanoparticle Research. please submit 4 original manuscripts

PERIODIQUES

(Rubrique assurée grâce au concours de M^{me} TAUZIN - FIN BiPSé)

N.B. : En cas de difficultés à vous procurer une copie des articles suivants, n'hésitez pas à contacter E. Gaffet (CNRS / IPSé - Belfort)

[45] ELECTROCHEMICAL BEHAVIOR OF NANOCRYSTALLINE Ti₂RuFe ALLOY PREPARED BY HIGH ENERGY BALL-MILLING

Roue L. Guay D. Schulz R. - Journal of Electroanalytical Chemistry. 455(1-2):83-92, 1998

The electrochemical behavior in alkaline solution (1 M NaOH) of a nanocrystalline alloy of Ti₂RuFe prepared by high-energy ball-milling was studied over its whole electroactivity domain, with a particular emphasis on the hydrogen evolution reaction (her). It was shown by both cyclic voltammetry experiments and chronopotentiometry measurements that the efficiency of the material for hydrogen evolution increases with time as hydrogen discharge proceeds. The electrochemical behavior of Ti₂RuFe following hydrogen discharge suggests that a hydride is formed during hydrogen evolution. This hydride formation leads to an irreversible increase of the effective electrochemical surface area. The effect of the hydride phase and increased surface area on the efficiency of the material for the her is discussed.

[44] PREPARATION OF N-TYPE BI-SB-TE THERMOELECTRIC MATERIAL BY MECHANICAL ALLOYING

Martinlopez R. Lenoir B. Dauscher A. Scherrer H. Scherrer S. - Solid State Communications. 108(5):285-288, 1998

The study of the Bi-Sb-Te ternary phase diagram allowed us to identify a zone in the Te-rich side of the diagram where n-type materials can be obtained. The solid solutions of Bi-Sb-Te were synthesized by mechanical alloying with a 10:1 ball to powder weight ratio. Two solid solutions showing n-type conductivity were found. They exhibit very promising carrier concentration values for thermoelectric applications.

[43] GRAIN GROWTH OF NANOCRYSTALLINE CRYOMILLED FE-AL POWDERS

Perez RJ. Jiang HG. Dogan CP. Lavernia EJ. - Metallurgical & Materials Transactions A-Physical Metallurgy & Materials Science. 29(10):2469-2475, 1998

Nanocrystalline Fe-xAl (x = 0, 2.6, or 10 wt pct) powders have been prepared using cryogenic mechanical alloying (cryomilling). The extremely low rate of diffusion of Al in Fe at the process temperature (-196 degrees C) effectively limits dissolution of Al in the nanocrystalline alpha Fe grains. Thermal stability against grain growth in the cryomilled Fe-Al mixtures is found to be much greater than that of identically prepared pure nanocrystalline Fe. Heat treatment of the cryomilled Fe-Al materials results in a highly inhomogeneous distribution of grain size and microchemistry. The observed thermal stability is evaluated in terms of Zener pinning, solute drag, and chemical ordering mechanisms.

[42] CRYSTALLIZATION AND DENSIFICATION OF NANO-SIZE AMORPHOUS CORDIERITE POWDER PREPARED BY A PVA SOLUTION POLYMERIZATION ROUTE

Lee SJ. Kriven WM. - Journal of the American Ceramic Society. 81(10):2605-2612, 1998

A homogeneous and stable amorphous-type cordierite (2MgO . 2Al(2)O(3). 5SiO(2)) powder was prepared by a solution-polymerization route employing a Pechini resin or a poly-(vinyl alcohol) (PVA) solution as the polymeric carrier. After calcination at 800 degrees C for 1 h under atmospheric conditions, the bulky precursor changed into a very soft and porous powder. A 30 nm size, amorphous-type cordierite powder was prepared by attrition milling the calcined powder, which was made using a PVA precursor solution. The nano-size powder, which had a high specific surface area of 181 m(2)/g, was obtained after milling for <1 h. The sintered cordierite grains did not show the presence of any amorphous SiO₂ phase and had a dense microstructure with a relative density of 99% and a thermal expansion coefficient of 2.1 x 10(-6)/degrees C.

[41] NMR STUDIES ON MIXING OF INSOLUBLE CONSTITUENTS DURING HIGH ENERGY MILLING

Shaw LL. Xie XQ. Ren RM. Yang ZG. - Scripta Materialia. 39(9):1169-1175, 1998

[40] FORMATION AND CATALYTIC ACTIVITY OF AMORPHOUS Ni₅₀Pd₄₀Si₁₀ ALLOY POWDER BY MECHANICAL ALLOYING

Zhang HF. Li J. Song QH. Hu ZQ. - Journal of Materials Research. 13(10):2779-2782, 1998

Amorphous Ni₅₀Pd₄₀Si₁₀ alloy powder was prepared by mechanical alloying. The surface states and catalytic activities of amorphous and crystalline Ni₅₀Pd₄₀Si₁₀ alloy powder pretreated with hydrofluoric acid (HF) solution were studied. The results show that amorphous Ni-Pd-Si alloy powder was easily prepared by mechanical alloying. After treating with HF solution, the number of Pd atoms on the surface of amorphous Ni-Pd-Si powder was obviously higher than that of the crystalline alloy and catalytic activity of amorphous Ni-Pd-Si powder was higher than that of the crystalline one by three times.

[39] POROUS NITIT ALLOY PREPARED FROM ELEMENTAL POWDER SINTERING

Li BY. Rong LJ. Li YY. - Journal of Materials Research. 13(10):2847-2851, 1998

An elemental powder sintering (EPS) technique has been developed for the synthesis of porous NiTi alloy, in which Ni and Ti powders are used as the reactants and TiH₂ powder is added as a pore-forming agent and active agent. Effects of various experimental parameters (sintering temperature, sintering time, and TiH₂ content) on the porosity, pore size, and pore distribution as well as phase composition in experimental alloys are investigated. It is found that in order to avoid the formation of carcinogenic pure Ni phase, the porous NiTi alloy should be synthesized over a temperature of 1223 K. This gives NiTi as the main phase without any elemental phase. Substitution of Ti by TiH₂ is more economic and more favorable to obtain homogeneous porous NiTi alloy. A proper selection of initial powders, ball-milling, pressing, and sintering process makes it possible to achieve the porous NiTi alloy with desired properties.

[38] TRANSITION METAL OXIDE CATALYZED CARBON BLACK OXIDATION

Mul G. Kapteijn F. Doornkamp C. Moulijn JA. - Journal of Catalysis, 179(1):258-266, 1998

Physical mixtures of carbon black and several transition metal oxides (Cr₂O₃, Co₃O₄, Fe₂O₃, MoO₃, V₂O₅, and K₂MoO₄) were treated batchwise in O-18(2) at 625-675 K in a high-vacuum batch reactor. Three reaction mechanisms are proposed to be operative in the catalyzed oxidation of carbon black. The isotopic reaction product composition ((CO)-O-16, (CO)-O-18, (CO₂)-O-16, (COO)-O-16-O-18, and (CO₂)-O-18) in experiments, in which O-18(2) and O-16(2) were fed alternately, showed that the amount of gas-phase oxygen incorporated in the products decreases in the series Cr₂O₃ > Co₃O₄ = Fe₂O₃ > MoO₃ > V₂O₅ > K₂MoO₄. Based on this trend, a surface redox mechanism is proposed for Cr₂O₃, Co₃O₄, and Fe₂O₃ catalyzed carbon black oxidation in which only surface oxygen (lattice oxygen of the oxide located in the surface layer) participates. Considering the formation of carbon surface oxygen complexes, and the relatively high fraction of O-18-labeled products obtained for Cr₂O₃ / carbon black mixtures, a spill-over mechanism, involving adsorbed surface oxygen, is suggested to run in parallel with the surface redox mechanism for Cr₂O₃. A "classical" redox mechanism, in which lattice oxygen from the bulk of the oxide is active, is proposed for MoO₃, V₂O₅, and K₂MoO₄. Significant carbothermic reduction of MoO₃ and V₂O₅ was observed in the absence of gas-phase oxygen. For K₂MoO₄ gas-phase oxygen is needed to keep the reaction going, although the highest amount of O-16-labeled products was obtained. K₂MoO₄ is not carbothermally reduced at the temperatures used. A "push-pull" mechanism seems to be operative for K₂MoO₄. Oxygen spill-over might also occur in the MoO₃-, V₂O₅-, and K₂MoO₄-catalyzed carbon black oxidation, in view of the formation of carbon surface oxygen complexes, but this plays a minor role in the overall oxidation mechanism.

[37] ASPECTS OF MECHANOCHEMICAL ACTIVATION IN TERMS OF COMMINUTION THEORY

Juhasz AZ. - Colloids & Surfaces A-Physicochemical & Engineering Aspects. 141(3):449-462, 1998

Material structural changes of solids during fine milling in air were investigated, which affect the structure and chemical properties of solids. In this respect, fine milling can be regarded as mechanochemical activation and interpreted by the disciplines of both general colloid chemistry and comminution theory. The importance of tension states generated by mechanical energy was proven by model experiments. By the help of practical examples, mechanochemical amorphisation of silicates and the crystal-chemical processes inducing this phenomenon were demonstrated. New investigation methods were developed, by which the activated systems can be better studied (oxygen density, permittivity, heat of dissolution, solubility). Examples were cited to show changes of reactivity and that of thermal reactions within activated systems.

[36] NMR RELAXATION STUDY OF ION DYNAMICS IN NANOCRYSTALLINE AND POLYCRYSTALLINE LiNbO₃

Bork D. Heitjans P. - Journal of Physical Chemistry B. 102(38):7303-7306, 1998

Nanocrystalline (n) LiNbO₃ was prepared by high-energy ball milling from the polycrystalline (p) material. Grain sizes were determined by XRD measurements and TEM images; thermal stability ranges of the samples were examined by DTA. NMR investigations of the diffusion-induced Li-7 spin-lattice relaxation (SLR) rate T-1(-1) of n-LiNbO₃ in the temperature range from T = 140 to 460 K at frequencies between $\nu = 24$ and 78 MHz revealed a reduced activation energy on the low-temperature side of the typical peak in a log T-1(-1) vs T-1 plot in comparison with results obtained from experiments performed on the p-material between 300 and 1400 K. Corresponding measurements of the SLR rate in the rotating reference frame yielded an asymmetric peak in the case of p-LiNbO₃, in contradiction to standard BPP theory, whereas in n-LiNbO₃ only a weakly temperature-dependent relaxation rate background was observed. Furthermore, neither in n- nor in p-LiNbO₃ BPP-type frequency dependencies of the SLR rate, i.e., T-1(-1) proportional to $\nu^{-\beta}$ with $\beta = 2$, were found. The determined values ranging from $\beta = 1.1$ to 1.5 are ascribed to the influence of structural disorder and Coulomb interaction on the diffusive motion.

[35] FORGING BEHAVIOUR AND PROPERTIES OF METAL MATRIX COMPOSITES BASED ON MECHANICALLY ALLOYED AL-MG-LI ALLOY

Styles CM. Pitcher PD. - Materials Science & Technology. 14(9-10):913-919, 1998

A range of Al-Mg-Li-C MMCs (25 vol.-% of 3 μ m SiC particles) were produced by mechanical alloying and powder processing at Aerospace Metal Composites, Farnborough. Upset forging trials were conducted at 350 and 550 degrees C and 0.01 and 0.1 s(-1). No SiC particle cracking or wedge cracking at grain boundary triple points was observed. Forging at 550 degrees C caused some edge clacking and a coarser grain structure. Large billets of varying composition were forged to similar to 15 mm thick plate at 350 degrees C and 0.01 s(-1) or 550 degrees C and 0.1 s(-1). Monotonic testing showed the MMCs to exhibit high stiffnesses at moderate strength levels but rather low ductility and fracture toughness. Significant strengthening was found to accrue from dispersion hardening (C content) and solid solution strengthening (Mg and Li solutes). A link was found between lower proof stress and coarser grain structure after forging at 550 degrees C. Fracture toughness K-1C was found to decrease with increasing yield strength which was attributed to higher strain concentrations in the smaller crack tip plastic zone. MST/4035.

[34] INFLUENCE OF MICROSTRUCTURE AND TEXTURE ON MECHANICAL PROPERTIES OF ALUMINIUM ALLOY 2124+5-PERCENT-SiC PARTICULATE COMPOSITES

Shamsul JB. Hammond C. Cochrane RF. Shakesheff AJ. - Materials Science & Technology. 14(9-10):949-958, 1998

A study of texture, microstructure, mechanical properties, and crack propagation mechanisms was carried out on aluminium alloy 2124 reinforced with 5 vol.-% SiC particles (3 μ m). Three fabrication techniques have been used to produce the composites. Composite I was fabricated by blending followed by hot isostatic pressing. Composite II was fabricated by mechanical alloying followed by hot isostatic pressing. Composite III was fabricated by agglomeration of aluminium powder by mechanical alloying followed by blending with SiC and hot isostatic pressing. All three composites were hot rolled to nominally 12.5 mm thick plate. Similar textures were observed for all composites. A model of the observed texture is {001} [211], {111} [211], and {211} [111] for rolling, side, and transverse planes respectively. Composite I showed a homogeneous distribution of SiC particles. Transmission electron micrographs of composite I showed good interface bonding, stacking faults present in SiC particles, and segregation of aluminium, oxygen, copper and magnesium to the inter face. Composites II and III showed ail

inhomogeneous distribution of SiC particles. The elastic modulus was slightly higher in the [211] direction than in the [111] direction. The fracture toughness of composite I was higher in the [211] crack direction whereas that for composite II and composite III was higher in the [111] crack direction. Secondary crack propagation modes follow the crystallographic orientations of {100} and {111} planes. MST/4039.

[33] MECHANICAL PROPERTIES AND MICROSTRUCTURE OF AL₂O₃- AND AL₄C₃-DISPERSION STRENGTHENED PM-AL-ALLOY

Nicolini G. Martin U. Elmagd E. Oettel H. - Metall. 52(9):508-513, 1998

The mechanical properties and microstructure of two Al₂O₃- and Al₄C₃-dispersion strengthened PM-Al-Alloys is investigated. The materials were manufactured by mechanical alloying, cold compaction and hot extrusion. The influence of different heat treatment conditions on the hardness is inspected as well as the hot hardness dependence on the test temperature. Compression and tensile tests were performed at different temperatures. The deformation behaviour under creep loading is discussed and the microstructure is characterized by transmission electron microscopy.

[32] PART II - SEMI-CONTINUOUSLY MECHANICAL ALLOYING IN A PRODUCTION SCALE USING CYCLE OPERATION

Zoz H. Ernst D. Reichardt R. Mizutani T. Nishida M. Okouchi H. - Metall. 52(9):521-527, 1998

The production of large quantities of powders for industrial application e.g. in paints or soldering materials is an aim followed by Fukuda Metal Foil and Powder Co. Ltd. in Japan. For these applications, Cu- and Ag-particles with a special geometry (flakes) are needed. Based on milling experiments resolved by the Simoloyer CM01-12 l with a grinding unit capacity of 0.5 l for laboratory purpose, a new grinding device has been developed using the same principle. This Simoloyer CM100s1, suitable for a semi-continuously production of mechanically alloyed and mechanically particle deformed powders [2-5], has been designed and already been described in part I of this work [9]. Part II focusses on testing for and on industrial application of the processing and the equipment as well as on principles regarding productivity and costs. A new application of the Maltoz-control-software for the determination of the energy consumption (energy balance) will be discussed. The batch operation procedure has already been done in Germany in September 1997. The efficiency of the system was even much higher than expected. The well-known problems when processing CMB-materials (ductility etc.) [1, 6, 7] were solved by using the Cycle Operation procedure controlled by the Maltoz-software [8]. A production capability of 600 kg of ready product per day with the testing plant has been achieved. The testing regarding the semi-continuous operation has been done in Kyoto in November 1997 and is discussed in the current paper.

[31] LEACHABILITY OF MECHANOCHEMICALLY PRETREATED CHALCOPYRITE

Balaz P. Havlik T. Kammel R. - Transactions of the Indian Institute of Metals. 51(1):1-6, 1998

This paper is concerned with possibility of chalcopryrite CuFeS₂ activation resulting in acceleration of its leaching with ferric sulphate. Mechanical activation of CuFeS₂ produced by grinding in a planetary mill brings about an increase in its specific surface area as well as disordering of its structure. The recovery achieved by leaching rises 2.7 - 7.7 times when compared with non-activated "as-received" sample. Activation of the mineral can also be accomplished by intensive grinding in the presence of copper, iron and sulphur. In this case, leaching lasting 60 minutes gives more than 20-fold increase in recovery of copper in leaching liquor. Among the products of mechanochemical reactions of CuFeS₂, the substances CuS, Cu₅FeS₄, Cu_{17.6}Fe_{17.7}S₃₂ and Cu₇S₄ can unambiguously be identified whereas the identification of Fe₃S₄, Cu₈Fe₈S₁₆ and Cu₂S is less certain.

[30] SYNTHESIS AND CHARACTERIZATION OF NANOCRYSTALLINE CO-CR COATINGS BY PLASMA SPRAYING

Lau ML. Strock E. Fabel A. Lavernia CJ. Lavernia EJ. - Nanostructured Materials. 10(5):723-730, 1998

The present paper describes the synthesis and characterization of nanocrystalline Co-Cr (ASTM F75) coating produced by plasma spraying for possible surgical implant applications. The feedstock powders were synthesized by mechanical milling to produce irregular agglomerates with an average grain size of less than 100 nm. The powders were then introduced into an argon plasma spray to successfully produce a nanocrystalline coating. Scanning electron microscopy and transmission electron microscopy were used to study the morphology of the nanometric particles and the resultant sprayed coatings. Microhardness and porosity measurements were performed on the conventional and the nanocrystalline coatings to characterize and compare the physical and mechanical properties.

[29] MICROSTRUCTURE, HARDNESS AND TOUGHNESS OF NANOSTRUCTURED AND CONVENTIONAL WC-CO COMPOSITES

Jia K. Fischer TE. Gallois B. - Nanostructured Materials. 10(5):875-891, 1998

The microstructure and mechanical properties of nanograin-sized WC-Co composites were investigated and compared with those of conventional cermets. The dislocation density in the nanometer-sized WC crystals is lower than in the conventional ones, and no inclusions are observed in them. Nanostructured composites have higher tungsten content in the binder phase and a higher FCC/HCP ratio of the cobalt. An amorphous phase is observed in the binder phase of the nanostructured samples. Hardness and surface toughness were investigated by performing Palmqvist indentations at loads from 0.025 to 40 Kg. The hardness increases with decreasing binder mean free path of dislocation in the binder phase. The high hardness of nanostructured cemented carbides results not only from the ultrafine microstructure, but also from alloy strengthening of the binder phase itself. The variations of hardness with load suggest that the finer grade conventional carbides have higher microfracture strength, and the nanostructured WC-Co composites are superior to the conventional ones in this respect. Bulk fracture toughness is related to cracks developing through the phases of the material. Palmqvist indentation toughness measurements show that the toughness decreases with increasing hardness in conventional composites, whereas the increase of hardness in nanostructured composites does not further reduce their bulk fracture toughness. This implies that different dominant toughening mechanisms exist in the conventional and nanostructured composites.

[28] DECHLORINATION OF CARBON TETRACHLORIDE IN WATER ON AN ACTIVATED ZINC SURFACE

Boronina TN. Klabunde KJ. Sergeev GB. - Mendeleev Communications. (4):154-155, 1998
imetallic enhancement with Pd, Ag and Au, or mechanical and cryochemical treatment, are shown to increase Zn(0) surface reactivity towards carbon tetrachloride in water and to promote both dechlorination and conversion into methane and other hydrocarbons.

[27] MICROSTRUCTURE-RELATED ANELASTIC AND MAGNETOELASTIC BEHAVIOR OF NANOCRYSTALLINE NICKEL

Bonetti E. Campari EG. Pasquini L. Sampaolesi E. - Journal of Applied Physics. 84(8):4219-4226, 1998
Nanocrystalline nickel was prepared by a planetary ball milling apparatus working in a vacuum of 10^{-4} Pa in the 150-300 K temperature range. The kinetic of the milling process and the microstructure evolution upon annealing were followed by x-ray diffraction and mechanical spectroscopy measurements. It was observed that thermal annealing up to 600 K induces a strong reduction of the internal strains without significant grain growth. Measurements of elastic energy dissipation and dynamic elastic modulus as a function of temperature showed that in the nanocrystalline samples, anelastic relaxation processes occur, with the activation energy of grain boundary diffusion. A systematic study of the magnetic field dependence of the dynamic modulus (Delta E effect) revealed a correlation between the Delta E magnitude and the strain values obtained by x-ray diffraction analysis.

[26] MECHANICAL PROPERTIES OF EXTRUDED BI85SB15 ALLOY PREPARED BY MECHANICAL ALLOYING

Martinlopez R. Zayakin S. Lenoir B. Brochin F. Dauscher A. Scherrer H. - Philosophical Magazine Letters. 78(4):283-287, 1998

The mechanical properties of the Bi85Sb15 thermoelectric alloy prepared by mechanical alloying and consolidated by hot extrusion have been investigated at 77 and 300 K. A three-point bending test was used in the course of this analysis because the stress state of sample in bending is similar to the distribution of stresses in a thermocouple of a Peltier cooling device. The modulus of rupture of the polycrystalline samples is roughly the same at the two studied temperatures with a value of about 100 MPa. This value is about ten times that obtained for Bi85Sb15 Single crystals prepared by the Czochralski method.

[25] TEMPERATURE DEPENDENCE OF DEFORMATION-ASSISTED CRYSTALLIZATION IN AMORPHOUS FE-78 B13SiG

Xu J. Atzmon M. - Applied Physics Letters. 73(13):1805-1807, 1998

Low-energy ball milling of amorphous Fe78B13Si9 has been performed at temperatures between 25 and 250 degrees C. Primary crystallization is observed after milling at elevated temperatures, but not after annealing at the same temperatures. Although milling at room temperature creates nucleation sites for primary crystallization, subsequent annealing at elevated temperature does not result in significant crystallization. Heating by ball impact and contamination by the milling tools during milling are ruled out as the causes for crystallization. The observed behavior is interpreted to be caused by diffusivity enhancement due to milling-produced defects.

[24] NANOSTRUCTURES, DISORDERED FERROMAGNETISM AND SPIN GLASSES

Vincze I. Kemeny T. Kaptas D. Kiss LF. Balogh J. - Hyperfine Interactions. 113(1-4):123-134, 1998

Magnetic systems with a considerable amount of irregular interfaces were investigated by Fe-57 Mossbauer spectroscopy. Chemically homogeneous ferromagnets around the percolation threshold composition of disappearing magnetism and chemically heterogeneous alloys prepared by nanocrystallization of amorphous alloys belong to this class of materials. Low temperature and high held measurements were performed on nanocrystalline FeZrBCu alloys, on ball-milled Fe with nano-size grains and on melt-quenched amorphous Fe-Zr and Fe-Y alloys in order to clarify the origin of large high-held susceptibility and to investigate the common features of the approach to magnetic saturation. Curie point determination of the residual amorphous phase in the nanocrystalline FeZrBCu alloys, results on the structure of the nanocrystalline b.c.c. phase and of the interfacial region will be reported.

[23] MICROSTRUCTURE AND GAS SENSITIVE PROPERTIES OF ALPHA-Fe2O3-MO2 (M SN AND TI) MATERIALS PREPARED BY BALL MILLING

Jiang JZ. Lin R. Morup S. - Hyperfine Interactions. 113(1-4):261-267, 1998

Metastable alpha-Fe2O3-MO2 (M: Sn and Ti) solid solutions can be synthesized by mechanical alloying. The alloy formation, microstructure and gas sensitive properties of mechanically milled alpha-Fe2O3-SnO2 materials are discussed. Tin ions in alpha-Fe2O3 are found to occupy the empty octahedral holes in the alpha-Fe2O3 lattice. This interstitial model can also describe the structure of alpha-Fe2O3-TiO2 solid solutions. Finally, a correlation of gas sensitive properties with microstructure of alpha-Fe2O3SnO2 materials is presented.

[22] TOOL INDUCED CONTAMINATION OF ELEMENTAL POWDERS DURING MECHANICAL MILLING

Sanchez FH. Torres CER. Vanraap MBF. Zelis LM. - Hyperfine Interactions. 113(1-4):269-277, 1998

Several metallic and semimetallic elements have been submitted to mechanical milling to investigate their contamination with chrome-steel milling tools. Contamination was followed with Fe-57 Mossbauer spectroscopy and X-ray diffraction. The contamination yield, defined as the number of incorporated Fe moles per gram of sample, was found to be more simply related to the Poisson ratio than to the Young, shear or bulk moduli, or to the enthalpy of mixing of the Fe-element couple.

[21] MECHANOCHEMICAL CATALYSTS IN CONVERSIONS OF C-1 MOLECULES (SYNTHESES OF METHANOL AND METHYL FORMATE, FISCHER-TROPSCH SYNTHESIS, AND WATER-GAS SHIFT REACTION

The catalysts based on Cu, Zn, Al, and Cr oxides were prepared by the mechanochemical treatment of solid components and tested in methanol synthesis, methanol dehydrogenation to methyl formate, Fischer-Tropsch synthesis, and water-gas shift reaction. It was shown that mechanochemical catalysts exhibited a high specific activity and their efficiency was comparable with that of the catalysts of a similar structure prepared by coprecipitation.

[20] MECHANOCHEMICAL COMPLEXATION BETWEEN DEOXYCHOLIC ACID AND SALICYLIC ACID

Limmatvapirat S. Yonemochi E. Oguchi T. Yamamoto K. - Journal of Inclusion Phenomena & Molecular

Recognition in Chemistry. 31(4):367-379, 1998

A complex between deoxycholic acid (DCA) and salicylic acid (SA) was prepared by grinding and coprecipitation methods. The resultant complex was characterized by means of powder X-ray diffractometry, IR spectroscopy and thermal analysis. The stoichiometry (DCA:SA 1:1) of the complex obtained by grinding was identical to that obtained by coprecipitation. The powder X-ray diffraction pattern of the DCA-SA complex differed from the typical pattern of DCA-guest complexes such as DCA-camphor and DCA-phenanthrene complexes. IR spectra suggested that a different kind of hydrogen bonding was formed in the crystal of the DCA-SA complex, compared with the other DCA-guest complexes. This was in good agreement with data from the crystal structure.

[19] A REVIEW OF COMPOSITE SAMPLING METHODS [Review]

Lancaster VA. Kellermcnulty S. - Journal of the American Statistical Association. 93(443):1216-1230, 1998

A composite is formed by collecting multiple sample units and combining them in their entirety or in part, to form a new sample. The sample units that make up the composite may retain their integrity or be homogenized through physical processes such as ball milling, sieving, shaking, or centrifuging. One or more subsequent measurements are taken on the composite and the information on the sample units is lost. This counterintuitive loss of information has fueled opposition to composite sampling, while the methodology's adherents find their motivation in its ability to reduce measurement costs for many classes of problems. This article reviews the scientific literature related to the development of composite sampling methods. The literature on compositing exists only as a compendium derived from disparate disciplines in which terms such as compositing, group screening, pooling, and weighing designs are used. The goal of this review is to synthesize this body of literature. The articles reviewed are limited to those that offer original applications or methodologies. A novel application in numerical regularization, is illustrated using data from an environmental investigation into mercury contamination at a waste disposal site in New Mexico. What is unusual about these data is the existence of measurements at both the composite and sample unit levels, thus allowing an opportunity to evaluate estimates based on composite sampling methods.

[18] ELECTRODE PROPERTIES OF MG2NI ALLOY BALL-MILLED WITH COBALT POWDER

Chen J. Bradhurst DH. Dou SX. Liu HK. - Electrochimica Acta. 44(2-3):353-355, 1998.

Mg₂Ni alloy prepared by induction was ball-milled with 3 wt% metallic cobalt powder. The effect of the ball-milling on the alloy structure and surface image was examined by X-ray diffraction (XRD) and scanning electron microscopy (SEM). The mixed alloy powders before and after ball-milling were pressed on to a porous nickel foam as the active material of a metal hydride electrode. Electrochemical characteristics of the two kinds of electrodes were investigated at 25 degrees. The discharge capacity, cycle life and high-rate discharge ability showed that the electrode properties were improved greatly by the ball-milling of Mg₂Ni and Co powder because of the changed structure and surface of the alloy.

[17] IMPROVEMENT IN MECHANICAL PROPERTIES OF CHROMIUM-NICKEL SINTERED COMPACTS BY REPEATED ROLLING AND ANNEALING

Harada Y. Ohmori M. Ando H. Matsui H. Okita T. - J. the Japan Institute of Metals. 62(9):868-875, 1998

Chromium-nickel sintered compacts containing 50 and 80 mass%Cr were tried to improve their mechanical properties by means of a thermo-mechanical treatment, i.e., repeated rolling and annealing. Specimens from the as-sintered compacts showed no ductility at room temperature and small ductility at temperatures higher than 1000 K because of poor alloying of nickel with chromium. Tensile properties of the sheets repeatedly rolled with the intermediate annealing at 1173 K were very similar to those of the as-sintered specimen. While the sheets rolled with the annealing at 1573 K were excellently improved in their strength and ductility due to the considerable interdiffusion of chromium and nickel. The intermediate temperature embrittlement, that is, the ductility minimum well observed around 1000 K in a chromium-nickel alloy appeared also in the sheets rolled with the annealing at 1573 K.

[16] THE EFFECT OF AL2O3 ADDITION ON THE MILLING BEHAVIOR OF NiAl POWDER

Tuan WH. - Journal of Materials Engineering & Performance. 7(5):613-616, 1998

The milling behavior of nickel aluminide, NiAl, powder in the presence of a fine Al₂O₃ powder was investigated in the present study. The milling was carried out in an attrition mill. The size and shape of NiAl particles were not changed after milling while only NiAl powder was milled. When fine Al₂O₃ powder was added to the NiAl powder, the Al₂O₃ particles attached to the surface of NiAl particles during milling. As a consequence, the size of NiAl particles was reduced after milling. The shape of NiAl particles also changed. The presence of fine Al₂O₃ particles enhanced the milling efficiency. The Al₂O₃ particles on the surface of NiAl powder can be removed by washing repeatedly in an ultrasonic bath.

[15] PREPARATION AND PROCESSING OF RARE EARTH CHALCOGENIDES

Gschneidner KA. - Journal of Materials Engineering & Performance. 7(5):656-660, 1998

Rare earth chalcogenides are initially prepared by a direct combination of the pure rare earth metal and the pure chalcogen element with or without a catalyst. The use of iodine (10 to 100 mg) as a fluxing agent (catalyst), especially to prepare heavy lanthanide chalcogenides, greatly speeds up the formation of the rare earth chalcogenide. The resultant powders are consolidated by melting, pressure assisted sintering (PAS), or pressure assisted reaction sintering (PARS) to obtain near theoretical density solids. Mechanical alloying is a useful technique for preparing ternary alloys. In addition, mechanical alloying and mechanical milling can be used to form metastable allotropic forms of the yttrium and heavy lanthanide sulfides. Chemical analysis techniques are also described because it is strongly recommended that samples prepared by melting should have their chemical compositions verified because of chalcogen losses in the melting step.

[14] DYNAMIC MECHANICAL PROPERTIES OF A NEAR-NANO ALUMINUM ALLOY PROCESSED BY EQUAL-CHANNEL-ANGULAR-EXTRUSION

Mukai T. Kawazoe M. Higashi K. - Nanostructured Materials. 10(5):755-765, 1998

Microstructure of AA5056 Al-Mg alloy is refined drastically to nano-scale by the equal-channel-angular-

extrusion(ECAE) process. Dynamic mechanical properties at room temperature in the ECAE processed 5056 Al-Mg alloy (5056-ECAE) are characterized by a modified Hopkinson-bar method. Yield stress (YS) in 5056-ECAE exhibits remarkably higher value than that of a fully annealed 5056 alloy(5056-O). Hall-Petch(H-P) relation of 5056 alloy is compared with those of a binary Al-Mg alloy and Aluminum. The slope of the H-P relation in the granular 5056 alloy is almost equal to that of a binary Al-Mg alloy with a similar content of magnesium, and larger than that of Aluminum. On the other hand, the slope of the sub-grained alloy exhibits lower value than that of the granular alloy. The result indicates that grains effectively refined by the ECAE process, however, the grain boundary strength of the sub-grained alloy is relatively lower than that of the granular alloy. The elongation-to-failure of 5056-ECAE exhibits a larger value than those of some fine-grained bulk aluminum alloys such as a mechanically alloyed aluminum. Fractography of 5056-ECAE revealed that this alloy was fractured with ductile dimples. The result supports the possibility that this alloy exhibits the high speed impact performance and capability for high-rate forming.

[13] SINTERING STUDY OF NANOCRYSTALLINE TUNGSTEN CARBIDE POWDERS

Gorenmuginstein GR. Berger S. Rosen A. - Nanostructured Materials. 10(5):795-804, 1998

WC powder with an average grain size of 6 nm was obtained after high energy ball milling under protective gas atmosphere. The kinetics of densification was studied during sintering the powder in a dilatometer up to 1450 degrees C. The microstructure was investigated by TEM and high resolution SEM after various stages of sintering. The green density of the specimens was 45%. Three stages of sintering were defined: (a) rearrangement of particles at low temperature (850 degrees C) without grain or par-tide growth, (6) neck formation between powder particles at 1000-1250 degrees C and initial grain growth at 1200 degrees C, (c) pore elimination accompanied by massive grain growth at 1300-1450 degrees C.

[12] MELTING OF EMBEDDED PB NANOPARTICLES MONITORED USING HIGH-TEMPERATURE IN SITU XRD

Sheng HW. Lu K. Ma E. - Nanostructured Materials. 10(5):865-873, 1998

Nanometer-sized Pb particles were embedded in Al matrices using ball-milling and melt-spinning techniques. The melting behavior of embedded Pb particles was monitored using high-temperature in situ X-ray diffraction (XRD) around the equilibrium melting temperature of Pb. Pb particles in ball-milled samples formed incoherent interfaces with Al and melted at temperatures below its equilibrium melting point, whereas those with coherent interfaces produced by melt spinning could be much superheated. In both cases, analysis of XRD data indicated that melting took place when the root-mean-square displacement of Pb atoms reached about 10% of their nearest-neighbor atomic distance, suggesting the applicability of the Lindemann melting criterion to nanocrystals. The atomic vibration amplitudes and characteristic Debye temperature of the embedded Pb particles have also been deduced from XRD data and found to vary with their interfacial structures, which is suggested to be the intrinsic reason for the influence of interface on melting.

[11] MECHANOCHEMICAL CATALYSTS IN CONVERSIONS OF C-1 MOLECULES (SYNTHESES OF METHANOL AND METHYL FORMATE, FISCHER-TROPSCH SYNTHESIS, AND WATER-GAS SHIFT REACTION)

Lin GI. Samokhin PV. Kaloshkin SD. Rozovskii AY.- Kinetics & Catalysis. 39(4):577-583, 1998

The catalysts based on Cu, Zn, Al, and Cr oxides were prepared by the mechanochemical treatment of solid components and tested in methanol synthesis, methanol dehydrogenation to methyl formate, Fischer-Tropsch synthesis, and water-gas shift reaction. It was shown that mechanochemical catalysts exhibited a high specific activity and their efficiency was comparable with that of the catalysts of a similar structure prepared by coprecipitation.

[10] FINE WET GRINDING OF AN ALUMINA HYDRATE IN A BALL MILL

Frances C. Laguerie C. - Powder Technology. 99(2):147-153, 1998

An experimental study on fine wet milling of an alumina hydrate in a batch ball mill has been carried out. The effect of experimental conditions of grinding have been determined showing that the size reduction rate is mainly affected by the fluidity of the slurry. This is related to the amount of fines in the load, the viscosity of the medium and the presence or not of chemical additives. The size distributions of comminuted particles exhibit a self-preserving behaviour as a function of time and can be properly described by a Rosin-Rammler-Bennett equation.

[9] ALUMINA-CHROMIUM CERMETS BY HOT-PRESSING OF NANOCOMPOSITE POWDERS

Guichard JL. Tillement O. Mocellin A. - Journal of the European Ceramic Society. 18(12):1743-1752, 1998.

Alumina-chromium cermets with up to 36 vol% metal have been prepared from powders obtained by high energy ball-milling. Firstly, the powder is prepared from initially blending Cr₂O₃ or CrO₃ and Al for reactive milling and from Al₂O₃ and Cr for a direct milling. The materials as-pressed at 1400 degrees C under 30 MPa consist of an alumina based matrix with metallic Cr inclusions. The difference of reactivities between Cr₂O₃ and CrO₃ during milling on the final material is discussed and the advantages of reactive compared to direct milling are emphasised. in a second part, the more efficient technique is used to obtain cermets with different compositions. Nanostructured powders were synthesized from Cr₂O₃, Al and Al₂O₃. The influence of chromium metal content is studied by microstructural observations, physical, mechanical and electrical properties evaluations. The expected improvement of mechanical properties compared to pure alumina is indeed observed. The importance of the milling time and the temperature-pressure cycle during the forming and sintering process are reflected on the final material structure and properties.

[8] SYNTHESIS AND CHARACTERIZATION OF NANOSIZED NIAL PARTICLES

T Chen, JM Hampikian - NANOSTRUCTURED POWDERS AND THEIR INDUSTRIAL APPLICATIONS (Series: MATERIALS RESEARCH SOCIETY SYMPOSIUM PROCEEDINGS), 1998, Vol 520, pp 205-210 - SYMPOSIUM ON NANOSTRUCTURED POWDERS AND THEIR INDUSTRIAL APPLICATIONS; SAN FRANCISCO, CALIFORNIA. APRIL 13-15, 1998

Nanophase NiAl powders were synthesized by solid state reaction via ball milling of elemental Ni and Al powders under an argon atmosphere for 0-8 h, 16 h, 24 h, and 48 h. Structural characterization of the nanophase NiAl was

performed by x-ray diffraction and transmission electron microscopy. The oxidation behavior of the powders was studied by thermogravimetric analysis. It was found that the Ni + Al = NiAl solid state reaction took place between 4 and 5 hours of mechanical alloying. After 5 h or more of mechanical alloying, the phase of the ball milled particles was the B2 structure, with average grain sizes which decreased with increasing mechanical alloying times. The relationship between the long-range-order parameters and mechanical alloying time was studied. After 5 h, 6 h, 8 h, 16 h, 24 h, and 48 h mechanical alloying, the long-range-order parameter was determined to be approximately 0.82, 0.75, 0.75, 0.75, 0.71, and 0.63, respectively. Iron contamination was observed, resulting from wear of the steel vial and balls. In the mechanically alloyed NiAl nanoparticles, edge dislocations, shear bands, subgrains, distorted regions, and a large number of grain boundaries were observed.

[7] PRODUCING CLAY-COATED QUARTZ POWDERS FOR SEMIDRY PRESSING OF WALL CERAMICS

GN Kryukova, PA Simonov, GI Storozhenko, GV Boldyrev - NANOSTRUCTURED POWDERS AND THEIR INDUSTRIAL APPLICATIONS (Series: MATERIALS RESEARCH SOCIETY SYMPOSIUM PROCEEDINGS), 1998, Vol 520, pp 233-238 - SYMPOSIUM ON NANOSTRUCTURED POWDERS AND THEIR INDUSTRIAL APPLICATIONS; SAN FRANCISCO, CALIFORNIA. APRIL 13-15, 1998

This paper discusses the potential of mechanochemical activation of low grade raw materials with carbonaceous inclusions to achieve high-quality building ceramics. The procedure proposed enabled us to produce clay-coated quartz powders thus facilitating further processing steps of semidry pressing and firing of the bricks, tiles and flagstones.

[6] MECHANOCHEMICAL ACTION ON ELECTROLYTIC MANGANESE DIOXIDE

Kononov YS. Zhizhaev AM. Kulebakin VG. - Russian Journal of Applied Chemistry. 71(4):722-723, 1998

Performance of a chemical power source based on mechanically activated manganese dioxide was studied.

[5] USE OF MECHANOCHEMICAL METHODS IN PREPARATION OF SUPPORTED CATALYSTS

Molchanov VV. Byanov RA. Goidin VV. - Kinetics & Catalysis. 39(3):434-439, 1998

Mechanochemical activation improves sorption by supporting materials, decreases the temperature of supported nickel chloride reduction, and increases the catalytic activity of supported nickel in ethylene hydrogenation. The reason for the improvement of sorption ability is the formation of a "juvenile" surface and outcrops of crystalline structure defects. A decrease in the temperature of supported nickel chloride reduction is due to the participation of conductivity electrons of mechanochemically activated supporting materials in some elementary steps or to the strengthening of O²⁻ anion electron-donor properties upon the mechanochemical activation of oxides. An increase in the catalytic activity can be explained by an increase in the dispersity of the supported metal and by the effect of support defects. A number of properties of catalytic systems are due to defects only.

[4] COMMINATION RESEARCH AT THE UNIVERSITY OF CAPE TOWN

Powell MS. Nurick GN. - Journal of the South African Institute of Mining & Metallurgy. 98(4):175-177, 1998

Comminution is a vital part of minerals extraction, and therefore of the South African economy. The high cost and throughput-limiting nature of comminution forms a strong motivation for research directed at improving the efficiency of the process. Building on a ten year background of fundamental charge motion research, a new formal UCT flotation and comminution group has been formed. The group is also moving strongly into the field of milling circuit modelling and simulation, based on close links formed with the Julius Kruttschnitt Mineral Research Centre (JKMRC) of Australia, and an international collaborative research programme.

[3] INFLUENCE OF STARTING PARTICLE SIZE OF ALUMINA POWDER PREPARED BY GRINDING ON THE SIZE OF PLATELIKE GRAIN IN THE RESPECTIVE SINTERED BODIES

Yokota K. Kondo Y. - Nippon Seramikkusu Kyokai Gakujutsu Ronbunshi-Journal of the Ceramic Society of Japan. 106(9):855-859, 1998

Controlling the size of anisotropic alumina grains such as platelike grains in the sintered body has been considered to be important for improving toughness of alumina ceramics. In this study, the relationship between particle size of powders and platelike grain size in sintered bodies were mainly studied in four kinds of fine-ground alumina powders with different average particle sizes and same amounts of impurities by wet rotation ball-milling. Platelike grain sizes were governed by the number of nuclei for growing into platelike grain in sintered bodies and the growth rate of those grains. The number of nuclei decreased and the growth rate of platelike grain increased with increasing particle sizes of powders. These results were attributed to the width of particle size distributions of powders. As a result, platelike grain sizes increased as particle sizes of powders increased. Therefore, it was possible to control the size of platelike grain by the particle size of the powder. All the slopes of growth isotherms of platelike grains in logarithmic plot were nearly equivalent, that is, the mechanism of platelike grain growth of all powders can be considered to be the same.

[2] MELTING AND FREEZING BEHAVIOR OF EMBEDDED NANOPARTICLES IN BALL-MILLED AL-10 WT-PERCENT M (M = IN, SN, BI, CD, PB) MIXTURES

Sheng HW. Lu K. Ma E. - Acta Materialia. 46(14):5195-5205, 1998

Nanometer-sized In, Sn, Bi, Cd, and Pb particles were homogeneously embedded in an Al matrix through ball milling of powder mixtures of pure immiscible elements. The melting and freezing behavior of the embedded nanoparticles were systematically investigated using differential scanning calorimetry. It was observed that the melting temperature as well as the latent heat of fusion of the embedded particles decreased significantly relative to their bulk values. Both the melting point depression and heat of fusion reduction are inversely proportional to the size of the embedded particles. The melting behavior is interpreted using a thermodynamic model and found to depend not only on the particle size but also on the structure and excess enthalpy of the particle/matrix interface. Solidification of the nanoparticles, presumably via heterogeneous solid nucleation at the Al/particle interfaces, exhibited significant undercooling. The degree of undercooling increased with decreasing particle size. A thermodynamic analysis based on the classical nucleation theory indicates that the large undercoolings observed result from the energy barrier for solid nucleation. The effect of particle size on undercooling is attributed to the size

dependence of the melting point.

[1] LOW ENERGY MECHANOCHEMISTRY : FORMATION OF SILVER AND COPPER METALS FROM HEMIOXIDES

H. Szwarc, M. Gasgnier - J. Solid State Chemistry, 136 (1998) 51 - 55

A number of oxides and mixtures of oxides with or without carbon have been ball - milled in home - made stainless steel vessels and the resulting compounds have been examined by X - ray powder diffraction. The expected trend to amorphization has been systematically observed. Moreover, chemical action developed in most cases. Copper oxides tend to be reduced from CuO to Cu₂O and metallic copper forms at the surface of the balls and diffuse some μm with the ball steel as revealed by energy dispersive X - ray spectroscopy. Mixtures of Ag₂O with carbon lead to small nuggets and square platelets of metallic silver and YBCO superconductor is decomposed into Y₂O₃, Cu₂O and some unidentified compounds. The behaviour of the balls has been observed visually. In the powder, an overall rotating motion is taking place revealing a crushing process instead of the expected smashing one.

=====

**Les membres du RFM ayant déjà réglé leur cotisation sont indiqués sur l'annuaire par (1998)
(Members having paid the RFM contribution are indicated by (year) in the RFM list)**

Bulletin d'adhésion 1998 / Subscription Print

(à retourner à l'adresse suivante - to be sent at the following address) :

Eric GAFFET

UPR CNRS 423 - Groupe "Nanomatériaux : Elaboration et Transitions de Phases Hors Equilibre"
IPSé - F90010 - Belfort Cedex - France

Nom/Name : **Prénom / First Name :**

Adresse complète / Full Address :
.....
.....

Téléphone/ Phone: **Télécopie (Fax) :**

e_Mel. / e-Mail :

désire adhérer au Réseau Français de Mécanosynthèse /want to be a member of the French Mechanical Alloying Network

Chèque ci joint / Check enclosed in the amount of 100FF

(Please do not use Eurocheck, the taxes do correspond to 40% of the amount of the check).

Correspondants du Réseau Français de Mécanosynthèse 130 Laboratoires ou Groupes de Recherche

Bureau : E. Gaffet (Président), G. Le Caër (Secrétaire Général), A.R. Yavari (Trésorier)

les personnes précédées par "•" sont inscrites sur la liste de diffusion électronique du RFM

Allemagne

• K.U. Kainer

Institut für Werkstoffkunde und Werkstofftechnik " Light Metals, Powder Metallurgy and Composites Group - Agricolastr. 6 - D 38678 - Clausthal Zellerfeld - Allemagne

• P. Reynders

Merck - Pigments Division) Bldg M18 - 64271 Darmstadt - Allemagne

• A. Sagel

Institut für Metallphysik und Technologie - Technische Universität Berlin - Hardenbergstr. 36 - PN 2 - 3 - D - 10623 - Berlin - Allemagne

• M. Veith

Universität des Saarlandes, Institut für Anorganische Chemie - Postfach 15 11 50 - D 66041 - Saarbrücken - Allemagne

Angleterre

• P. Shashi

De Montfort University - Emerging Technologies Research Centre - SER Centre - Howthron Building - Gateway - Leicester LE1 9BH - Royaume Uni

Argentine

• F.H. Sanchez (97)

Dpto de Fisica - Universidad Nacional de La Plata - CC67 - 1900 La Plata - Argentina

• L. Mendoza - Zelis (97)

Dpto de Fisica - UNLP - CC 67 - 1900 La Plata - Argentine

Australie

• A. Calka(1997)

Dep. Materials Engineering - University of Wollongong - NSW 2522 - Australie

• S.J. Campbell

School of Physics - University College - The University of New South Wales - Australian Defence Force Academy - Canberra ACT 2600 - Australie.

• Y. Chen (1997)

Dep.Elec. Mat. &Eng. - RSPHYSSE - The Australian Nat. Univ. - Canberra ACT 0200 -

• J. Harrowfield (1998)

Chemistry Department - Un. of Western Australia - Nedlands - WA 6907 - Australie

• F.J. Lincoln

Special Research Centre for Advanced Mineral and Materials Processing -

• J. Nikolov

Univ. Western Australia - Nedlands, Perth - Western Australia 6907 - Australie

• W. Kaczmarek

The Australian National University - Canberra ACT 0200 - Australie.

Dpt Appl. Mathematics - Institute of Advanced Studies - Research School of Physical Sciences & Engineering - The Australian National University - Canberra ACT 0200 - Australie.

Brésil

• W.J. Botta - Filho

Dept. Eng. Mater. -Univ. Federal Sao Carlos - CP 676 - 13565 - 090 - Sao Carlos Sp. - Brésil

• A. de Matos Dias

Materials Science & Eng. Dpt - Universidade Luterana do Brasil - Canoas - RS - Brésil

• R. S. de Figueiredo(97)

Lab. Magn.& Mat. Magn. - Dep. de Fisica - Cxp 6030 - 60.455 - 760 Fortaleza CE - Bresil

• G.F. Goya

Lab. Materiais. Magneticos - Instituto de Fisica - Univ. Sao Paulo - CP 66318 - Brésil

Canada

• J. Huot*

IREQ - Techn. des Matériaux - 1800 Boul. L. Boulet - Varennes, Quebec, Canada J3X ISI

• J.-Y. Huot

Noranda Technology Centre - 240 Hymus Blvd - Pointe Claire - Que, H9R 1G5 - Canada

• L. Roué (1998)

INRS - En. & Mat.- 1650 Bd Lionel Boulet - Case Postale 1020 -Varennes (Québec) J3X 1S2 •

A. Van Neste

Mines & Métallurgie - Un. de Laval - Pav. Pouliot, Ste - Foy Campus - GIK 7P4 - Quebec -

Canada

• W.J. D. Shaw

Dept. Mech. Eng. - University Calgary - T2N 1N4 - Calgary Alberta - Canada

Chine

• J. Li

Dept Materials Science - Lanzhou University - Lanzhou 73000 - Chine

• K. Lu

State Key Lab for RSA - Institute of Metal Research - Chinese Academy of Sciences -

• L. Wei

Shenyang 110015 - P.R. Chine

Institute of Metal Research - Chinese Academy of Sciences - Shenyang, 110015 - P.R. China

Corée du Sud

• J.-H. Ahn

Dept. Materials Engineering - Andong National University

388 Songchon - Dong, Andong, Gyungbuk 760 749 - Corée du Sud

• S. H. Hong

Dept. Mat. Sci. & Eng. - Korean Advanc. Inst. of Science and Technology

373 - 1 Kusong - Dong, Yusung - Gu - Taejon, 305 - 701 - Corée du Sud

Croatie

• M. Stubicar (1998)

Department of Physics - Faculty of Science, P.O. Box 162 - 10001 Zagreb - Croatie

• Andjelka. Tonejc

Dpt Physics - Lab. Microstr. Investig. - Bijenicka 32 - PO Box 162 - 10001 Zagreb - Croatie

• Antun Tonejc

Dpt Physics - Lab. Microstr. Investig. - Bijenicka 32 - PO Box 162 - 10001 Zagreb - Croatie

Danemark

• J. Z. Jiang

Dept Physics - Tech. Univ. Denmark - Bldg 307 - DK 2800 - Lyngby - Danmark

Espagne

- P. Crespo(1997)

CENIM - CSIC, Avda G de Amo, 8 - 28040 - Madrid Espagne

Grèce

- G. Kiriakidis

Materials Group - Institute of Electronique Structure and Laser (IESL)
Foundation for Research and Technology - Hellas (Forth)
Science & Technology Park of Crete - Vassilika Vouton, Heraclion Crete
P.O Box 1527 GR - 71110 - Grèce

Hongrie

- T. Kemeny (1997)
- L.K. Varga

Research Institute for Solid State Physics - 1525 Budapest - P.O. Box 49 - Hongrie
Research Institute for Solid State Physics - P.O.B. 49 - H- 1525 - Hongrie

Inde

- B.S. Murthy

Dpt Metallurgical & Materials Engineering - Indian Institute of Technology -
Kharagpur - 721 302 - Inde

Israel

- M.P. Dariel (1998)
- N. Frage
- A. Gedanken
- E. Gutmanas

Dept. Materials Engineering - Ben Gurion University of the Negev - Beer Sheva - Israel
Dept. Materials Engineering - Ben Gurion University of the Negev - Beer Sheva - Israel
Dpt of Chemistry - Bar - Ilan University - Ramat - Gan; Israel 52900
Technion - Israel

Italie

- D. Basset (1998)
- S. Enzo
- M. Magini (1997)
- P. Pierrat*

M.B.N. srl - Via Roma - 4 - I31020 - San Vendemiano (TV) Italie
INFM & Dipartimento di Chimica - Univ. Sassari - Via Vienna 2 - 07100 Sassari - Italie
ENEA - Dipart INNOVAZIONE - C.R. Casaccia - Via Anguillarese, 302 - I00060 Rome - Italie
Dipartimento di Scienze e Technologie Chimiche
Università degli Studi di Udine - Via del Cottonificio 108 - 33100 Udine - Italie

Japon

- J.Y. Huang
- M. Senna
- M. Umemoto

Nat. Inst. Research in Inorganic Materials (NIRIM) - Namiki 1 - 1, Tsukuba, Ibaraki -305 Japon
Keio Univ.-Fac. Sci. Tech. -Dpt. Appl. Ch.- 3-14-1 Hiyoshi Kohoku-ku-223 Yokohama - Japon
Fac. Engin. - Toyohashi Univ. Technology - Tempaku - Cho Toyohashi Aichi 441 - Japon

Pologne

- T. Jańta
- D. Oleszak
- B. Weglinski

Technical University of Wroclaw - Inst. of Electric Machines & Drive - Wybrzeze
Wspianskiego 27 - Wroclaw 50 - 370 - Pologne
Dept Mater. Sci.& Eng. - Warsaw Univ. Techn. - Nabutta 85 - 02 - 524 - Pologne
Technical University of Wroclaw - Inst. of Electric Machines & Drive - Wybrzeze
Wspianskiego 27 - Wroclaw 50 - 370 - Pologne

Portugal

- B. Oliveira e Costa (97)

Dpto de Fisica - Faculdada de Ciencias et Tecnologia - Universidade de Coimbra -
3000 Coimbra - Portugal

Roumanie

- M. Lozovan

National Institute of R&D for Technical Physics, 47 Mangeron Blvd, 6600 IASI 3 - Roumanie.

Russie

- N.Z. Lyakhov
- R.Z. Valiev
- A.N. Strelestskii
- A. Y. Yermakov
- A.Y. Zubarev

Inst. Sol. State Chem.- Russian Acad Sci. - Kutaleladze, 18 - Novosibirsk - 630128 Russia
Ufa State Aviation Technical University - Inst. of Physics of Advanced Materials -
12 K. Marks Str., UFA 450000 - Russie
Inst. Chem. Phys. - RAS, Dept Kinetics & Catalysis - Kosygina Str. 4 - Moscou - Russie
Applied Magnetism Lab. - InstituteMetal Physics - 18 S. Kovalevskaya St. - GSP -
170 - Ekateringurg - 620219 - Russie
USU - Russie

Singapour

- Lu Li

Dpt Mechanical and Production Engineering - The National University of Singapore -
10 Kent Ridge Crescent - Singapore - 119260 - Singapour

Slovaquie

- P. Baláž
- K. Kristiakova

Institute of Geotechnics - Watsonova 45 - 04353 Kosice - Slovaquie
Institute of Physics - Dubravska Cesta 9 - SK - 842 28 Bratislava - Slovaquie

Suède

- L.B. Kiss
- A. Salwen

Nanomaterials and Noise Projects - Dpt Materials Science - The Angstrom Lab. Uppsala Univ.
P.O. Box 534 - Uppsala, SE - 75121 - Suède
Swedish Inst. Metals Res. - Drottning Kristinas V. 48 - Stockholm S 114 - 28 - Suède

- S.J. Savage

Dept of Materials - Defence Research Establishment - SE - 172 90 - Stockholm - Suède

Suisse

- D. Morris (1998)

Université de Neuchâtel - Institut de Métallurgie Structurale - CH 2000 Neuchâtel

U.S.A.

- P. Bellon
- Xiabao Fan

Dpt Materials Science and Engineering - 1304 W. Green St. - Urbana IL 61801 - USA
Nanomaterials Research Corporation-2620 Trade Centre Avenue-Longmont CO80503-USA

- E. Y. Ivanov
- J.N. Newkirk
- R.E. Riman

Tosoh SMD Inc., 3600 Gantz Road, Grove City - Ohio 43123 USA
Dept Metallurgical Eng. - Univ. Missouri - Rolla - Rolla MO 65409 USA.

- L. Takacs

Dept Ceramic and Materials Engineering - Rutgers University - P.O. Box 909 - Piscataway, NJ 08855 - 0909 USA

Univ. Maryland - Baltimore Country - Dpt Physics - 1000 Hilltop Circle - USA

Viet Nam

- Pham Khac Hung
- To Ba Van

ITIMS - 1 Round, Dai Co Viet, Hanoi Viet Nam

Institute of Materials Science - HCMC Branch, NCST 01 Mac Dinh Chi, Dist 1 - Hochiminh City - Vietnam

France

- H. Ageorges*
- M. Arigon (1998)

Lab. Thermodyn. Trait. Poudres - Fac. Sciences - 2 Bd Lavoisier - F49045 - Angers Cedex

Roucaire Instruments Scientifiques - 2, Avenue du Pacifique, Les Ulis - BP 78 F91943 Courtaboeuf Cedex

- L. Aymard
- D. Aymes (1997)

LCRS - 33 Rue de Saint Leu - F80039 - Amiens Cedex

LRRS - CNRS UMR 5613 - Equipe "Matériaux à Grains Fins" - Université de Bourgogne

UFR Sciences et Techniques - 9 Avenue Alain Savary - BP400 - F21011 Dijon Cedex

- M.-I. Baraton (1997)
- J.-F. Baumard*
- S. Begin - Colin (1998)
- F. Bernard*

LMCTS ESA 6015 - Fac des Sciences 123 Avenue A. Thomas - F87060 Limoges Cedex

ENSCI - 47 Avenue A. Thomas - F87065 Limoges Cedex

LSG2M- CNRS- Ecole des Mines - F54042 - Nancy Cedex

LRRS - CNRS UMR 5613 - Equipe "Matériaux à Grains Fins"

Faculté des Sciences de Mirande - BP 138 - F21004 - Dijon Cedex

- Ph. Blanchard (1997)
- J.L. Bobet (1998)
- A. Briantais (1997)

Saft Recherche - Route de Nozay - F91460 Marcoussis

ICMCB - Bordeaux

CREPI - PSA - Direction des Methodes et Equipements Industriels - Batiment Forge

Route de Chalampé - BP 1403 - F68071 Mulhouse Cedex

Faure Equipements - BP 52 - 21 Rue Santos Dumont - F87002 Limoges Cedex

CEN Saclay - DTA / CEREM / DECM / SRMP - F91191 - Gif/Yvette Cdx

- J.-M. Castillo (1997)
- L. Chaffron*
- F. Charlot*

LRRS - CNRS UMR 5613 - Equipe "Matériaux à Grains Fins" - Université de Bourgogne

UFR Sciences et Techniques - 9 Avenue Alain Savary - BP400 - F21011 Dijon Cedex

Lab. Métal. Phys.- URA CNRS 131 - Bd 3, Téléport 2 - BP 179 -F86960 - Futuroscope Cedex

LRRS - CNRS UMR 5613 - Equipe "Matériaux à Grains Fins" - Université de Bourgogne

UFR Sciences et Techniques - 9 Avenue Alain Savary - BP400 - F21011 Dijon Cedex

Schneider Electric - Dir. Rech. Matériaux/A3 - Rue Henri Tarze - F38050 - Grenoble Cedex 9

CNRS - Lab de Chimie Métallurgique des Terres Rares - 2 - 8 Rue H. Dunant - F94320 Thiais

LASIR - HEI (CNRS UPR 2631) - 13 Rue de Toul - F59046 Lille Cedex

Lab. de Structure des Mat. Métal. - Bât. 413 - 414 - Un. Paris Sud - F91405 - Orsay Cedex

Ecole des Mines d'Albi - Campus Jarlard - F81013 Albi Cedex 04

LMIT - IUT Belfort - BP 527 - 90016 - Belfort Cedex

Laboratoire de ThermoMécanique - IPSé - F90010 - Belfort Cedex

Lab. Métal. Phys. - URA CNRS 131 - Bd 3, Téléport 2 - BP 179-F86960 - Futuroscope Cedex

Laboratoire de ThermoMécanique - IPSé - F90010 - Belfort Cedex

Lab. Magn. & Appl. -URA 808 -Univ. Rouen-UFR Sci.& Tech-F76821 - Mt St Aignan Cdx3

Lab. de Métallurgie Physique Univ. Lille 1 - Bat C6 - 2ème Et. -F59655 - Villeneuve d'ascq

LPMS - CNRS D0407 - Univ. Montpellier II - Sci. et Techn. du Languedoc

Place E. Bataillon - F34095 - Montpellier Cedex 5

Lab. de Cristallographie - UPR CNRS 5031 - BP 166 - F38042 - Grenoble Cedex

Lab. Thermodyn. Mét. - URA CNRS 158 - Univ. Nancy I - B.P. 239-54506-Vandoeuvre Cdx

CNRS UPR 423 "Elab. et Transitions de Phases Hors Equilibre"-IPSé -F90010 - Belfort Cedex

Lab. Central de Recherches - Thomson CSF Domaine de Corbeville - F91404 - Orsay

LSG2M- CNRS- Ecole des Mines - F54042 - Nancy Cedex

Ecole des Mines - St Etienne - France

Lab. Fluorures - UPRES CNRS A 6010 - Fac des Sciences - Av. O. Messiaen - 72985-Le Mans Cdx

LRRS - CNRS UMR 5613 - Equipe "Matériaux à Grains Fins"- Université de Bourgogne

UFR Sciences et Techniques - 9 Avenue Alain Savary - BP400 - F21011 Dijon Cedex

Eq. Physique de l'Etat Condensé - Univ. du Maine - Fac Sciences - F72017 - Le Mans Cdx

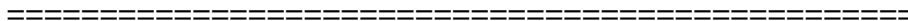
LETAM - Université de Metz - 57045 Metz Cedex 01

Lab. Chimie du Sol. Minéral - CNRS - B.P. 239 - Vandoeuvre les Nancy Cedex

Université de Compiègne - Génie Chimique - BP 529 - F60205 - Compiègne

- J- M. Greneche *
- T. Grosdidier (1998)
- D. Guerard (1997)
- P. Guigon (1998)

- B. Guilhot*
 - V. Hays*
 - J. - C. Jumas (1997)
 - Ph. Kapsa (1998)
 - D. Klein
 - F.A. Kuhnast (1998)
 - Y. Labaye*
 - P. Lacorre(1998)
 - M. Latroche
 - G. Le Caër (1998)
 - N. Lecomte (1997)
 - J.M. Lecuire (2000)
 - C. Lemoine (1998)
 - C. Lenain
 - S. Lenard
 - C Levaillant (1998)
 - N. Lorrain (1998)
 - B. Malaman (1998)
 - C. Massobrio (1997)
 - C. Meunier (1998)
 - D. Michel (1997)
 - P. Millet*
 - N. Millot*
 - Ph. Molinié (1998)
 - C. Monty (1998)
 - F. Nardou (1997)
 - M. Nathl (1998)
 - G. Nicolas (1998)
 - J.-C. Niepce*
 - V. Nivoix (1998)
 - F. Pellerin
 - A. Percheron-Guegan(97)
 - P. Perriat*
 - P. Pochet*
 - R. Rahouadj*
 - N. Randrianantoandro *
 - D. Ravot
 - R. Retoux (1998)
 - Cdx
 - S. Revol (1998)
 - S. Rimlinger (1997)
 - B. Rondot*
 - M. Sarfati (1997)
 - H. Scherrer*
 - G. Silly*
 - H. Souma (1997)
 - N. Spath (1997)
 - M. Stamm (1997)
 - J. Steinmetz (1998)
 - H. Szwarc (1998)
 - J. Teillet (1998)
 - F. Thévenot (1998)
 - I. Tkatchenko (1997)
 - A. Venot (1997)
 - R. Welter (1997)
 - R. Yavari
 - M. Zeghmati (98)
 - M. Zouggar (1998)
 - C. Zinc *
 - Cdx
- ENSMSE - **Lab. Physicochimie Matériaux** - 158 Cours Fauriel - F42023 St Etienne Cdx
- Lab. de Génie des Matériaux** - ISITEM - CP3023 - F44087 - Nantes cedex 03
- LPMS - CNRS D0407** - Univ. Montpellier II - Sci. et Techn. du Languedoc
Place E. Bataillon - F34095 - Montpellier Cedex 5
- Lab. Tribologie & Dynamique des Systèmes** - UMR CNRS 5513
Dpt de Technologie des Surfaces - Ecole Centrale de Lyon, BP 163 - F69131 Ecully Cedex
- LMIT** - Portes du Jura - F25000 Montbéliard
- LCSM** - URA CNRS 158 - Univ. H. Poincaré - Nancy I - F54506 Vandoeuvre Cedex
- Eq. Physique de l'Etat Condensé** - Univ. du Maine - Fac Sciences - F72017 - Le Mans Cdx
- Lab. Fluorures** - UPRES CNRS A 6010 - Fac des Sciences - Av. O. Messiaen - 72985-Le Mans Cdx
- LCMSTR - CNRS** - 1 Place A. Briand - F92195 - Meudon Cedex
- LSG2M- CNRS** - Ecole des Mines - F54042 - Nancy Cedex
- Ressources en Innovation** - 49 Rue Edouard Herriot - F69002 Lyon
- Lab. d'Electrochimie des Matér.** - Univ. de Metz - Ile de Saulcy - F57045 - Metz Cedex
- Lab. Magn. & Appl.** -URA 808 -Univ. Rouen-UFR Sci.& Tech-F76821 - Mt St Aignan Cdx3
- Lab Réactivité & Chimie des Solides** - CNRS Université d' 80039 Amiens - France
- Univ. Metz - 57 Metz
- Centre Matériaux** - Ecole Mines d'Albi Carmaux - Rue de la Poudrière-F81013 - Albi Cedex 09
- CEN Saclay** - DTA / CEREM / DECM / SRMP - F91191 - Gif/Yvette Cdx
- Labo de Chimie Minérale** - Univ. de Nancy I - B.P. 239 - F54406 - Vandoeuvre Cedex
- IPCMS - Groupe Etude Matériaux Métal.** - 23 Rue du Loess - F67037 - Strasbourg Cedex
- LMIT** - Portes du Jura - F25000 Montbéliard
- CECM / CNRS** - 15 Rue G. Urbain - F94407 - Vitry / Seine Cedex
- CEMES** - UPR CNRS 8011 - 29 Rue Jeanne Marvig - BP 4347- F31055 Toulouse Cedex
- LRRS** - CNRS UMR 5613 - Equipe "Matériaux à Grains Fins"- Université de Bourgogne
UFR Sciences et Techniques - 9 Avenue Alain Savary - BP400 - F21011 Dijon Cedex
- IMN** - UMR CNRS 110 - 2 Rue de la Houssinière - BP 32229 - F44322 - Nantes Cedex 03
- IMP** - CNRS - BP5 - Odeillo - F66125 Font Romeu Cedex
- LMCTS**- Eq. "Céramiques Nouvelles" - 123 Avenue Albert Thomas - F87060 - Limoges Cedex
- ICMCB** - Bordeaux
- CIME Bocuze SA** - BP 301 - St Pierre en Faucigny - F74807 - La Roche / Foron Cedex
- LRRS** - CNRS UMR 5613 - Equipe "Matériaux à Grains Fins"- Université de Bourgogne
UFR Sciences et Techniques - 9 Avenue Alain Savary - BP400 - F21011 Dijon Cedex
- Lab. d'Analyse de Spectroscopie et de Traitement de Surface des Matériaux** - Université de Rouen
LASTSM - I.U.T. - 76821 Mont St Aignan Cedex - France
- Turboméca** - 64511 - Bordes Cedex
- CNRS** - Lab de Chimie Métallurgique des Terres Rares - 2 - 8 Rue H. Dunant - F94320 Thiais
- LRRS** - CNRS UMR 5613 - Equipe "Matériaux à Grains Fins"- Université de Bourgogne
UFR Sciences et Techniques - 9 Avenue Alain Savary - BP400 - F21011 Dijon Cedex
- GEMPPM** - INSA Lyon - Bat 303 - 69621 Villeurbanne Cedex
- Laboratoire de ThermoMécanique** - IPSé - F90010 - Belfort Cedex
- Eq. Physique de l'Etat Condensé** - Univ. du Maine - Fac Sciences F72017 - Le Mans Cdx
- Lab. Phys. Mat. Cond.**-Univ. Montpellier II-Place E. Bataillon-F34095-Montpellier Cdx5
- Lab. Fluorures** - UPRES CNRS A 6010 - Fac des Sciences - Av. O. Messiaen - 72985-Le Mans Cdx
- CENG- CEREM** - 17 Rue des Martyrs - F38054 - Grenoble Cedex 9
- CERMEP** - 54 Avenue Rhin et Danube - B.P. 62 - 38041 Grenoble Cedex 9
- LMIT** - IUT Belfort - BP 527 - F90016 - Belfort Cedex
- ETCA** - 16 bis avenue du Prieur de la Cote d'Or - F94114 Arcueil Cedex
- LSPM - URA CNRS 155** - Ecole des Mines - Parc de Saurupt - F54042 - Nancy Cedex
- Eq. Physique de l'Etat Condensé** - Univ.Maine - Fac Sciences - F72017 - Le Mans Cedex
- LRRS** - CNRS UMR 5613 - Equipe "Matériaux à Grains Fins" - Université de Bourgogne
UFR Sciences et Techniques - 9 Avenue Alain Savary - BP400 - F21011 Dijon Cedex
- Comptoir Lyon - Alemand - Louyot**- CR - 8, Rue Portefoin - F75003 - Paris
- C2M Technology** - C.E.E.I Zone Industrielle Ste Agathe - Rue Lavoisier- F57192 - Florange
- Labo de Chimie Minérale** - Univ. de Nancy I - B.P. 239 - F54406 - Vandoeuvre Cedex
- Lab. Chimie Phys. Mat. Am.** - CNRS URAD1104 - Bat. 490 - Univ. Paris Sud - Orsay F91405
- Lab. Magn. & Appl.** -URA 808 -Univ. Rouen-UFR Sci.& Tech-F76821 - Mt St Aignan Cdx3
- ENSMSE** - Lab. Céramiques Spéciales - 158 Cours Fauriel - F42023 - Saint Etienne Cedex
- CNRS/ Institut Recherche Catalyse** - 2 Avenue A. Einstein -F69626 Villeurbanne Cedex
- SINTERTECH** - Centre R & D- Voie des Collines - F38800 Le Pont de Claix - France
- Labo de Chimie Minérale** - Univ. de Nancy I - B.P. 239 - F54406 - Vandoeuvre Cedex
- INPG - LTPCM - CNRS URA 29** - ENSEEG, 1130 Rue de la Piscine
Domaine Univ. - BP 75 - F38042 - Saint Martin d'Hères - France
- LMIT** - IUT Belfort - BP 527 - F90016 - Belfort Cedex
- Lab. Métal. Phys.**- UMR 6630 - Bd 3, Téléport 2 - BP 179 -F86960 - Futuroscope Cedex
- Thann & Mulhouse, Usine de Thann-Serv. PCA-95 Rue du Gal de Gaulle BP 34- 68801 Thann Cdx



N.B. : Pour la rédaction du prochain N° de la Lettre du Réseau Français de Mécanosynthèse, tout(e) article, annonce, thèse ... peut être envoyé(e) à :

Eric Gaffet - CNRS UPR A0423
Groupe "Nanomatériaux : Elaboration et Transitions de Phases Hors Equilibre"
IPSé - F90010 Belfort Cedex
Tél. : 84 - 58 - 31 - 02 / Fax : 84 - 58 - 30 - 27
E-mail : Eric.Gaffet@utbm.fr