RESEAU FRANÇAIS DE MECANOSYNTHESE

Lettre N°72

Mars 2001

181 Groupes de Recherche

(dont 108 à l'étranger / 32 Pays)

Bureau du RFM : E. Gaffet (Président)

G. Le Caër (Secr. Gén.), A.R. Yavari (Trés.)

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SOMMAIRE

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Le site web du RFM est :
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'2001 et quelques éléments mis a jour régulièrement concernant les derniers résultats dans ce domaine.

Bulletin d'adhésion 2001 / Subcription Print

(à retourner à l'adresse suivante - to be sent at the following address) :
Eric GAFFET
CNRS UMR5060 « Métallurgies et Cultures »
Thème « Nanomatériaux : Elaboration et Transitions de Phases Hors Equilibre »
Site de Sévenans (UTBM)
F90010 - Belfort Cedex - F'rance

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 become a member of the French Mechanical Alloying Network
Chèque ci joint / Check enclosed in the amount of 100FF
The check has to be to the order : Reseau Francais de Mecanosynthèse

Corresp. : mailto:Eric.Gaffet@utbm.fr

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

JRFM' 2001

6 émes Journées du Réseau Français de Mécanosynthèse
Amiens
Pôle Scientifique Faculté des Sciences
Les 21 et 22 mai 2001
http://www.u-picardie.fr/colloque/jrfm

Thématique 2001:
Influence de la Mécanosynthèse sur les Propriétés
Physico - Chimiques des Matériaux

Fiche d'Inscription
(à renvoyer à Luc AYMARD avant le 31.01. 2001)

Nom: ..... Prénom: .....
Téléphone: .....Fax:..... E-mail:
Adresse de Facturation:.....

* Pour les laboratoires propres,UMR ou associés au CNRS, indiquer le code et l'adresse complète de l'Unité. **Une facture sera établie directement à leur encontre.**
* Pour les agents CNRS merci d'indiquer votre indice majoré: .....
(nécessaire pour obtenir un discount pour les déjeuners)

Frais d'inscription: (comprenant recueil des résumés, 2 déjeuners, un dîner)

Déjeuner du 21 mai oui / non
Banquet du 21 mai soir oui / non (merci d'entourer les réponses)
Déjeuner du 22 mai oui / non

Tarifs : Etudiant(e)s de thèse : 100 Frs. Autres participant(e)s: 400 Frs.

Mode de paiement :

* Dès la réception du bulletin d'inscription dûment complété par vos soins et d'un chèque ou d'un bon de commande établi à l'ordre de VERNE ADER,
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Conditions de résiliation: En cas de désistement, aucun réglement ne sera restitué.
.....
Fiches d'inscriptions et résumés à retourner avant le 31 02 2001 à Luc Aymard
(JRFM 2001) Faculté des Sciences, LRCS
33 rue Saint leu Amiens 80000
tel: 03 22 82 75 74 fax : 03 22 82 75 90 e-mail: luc.aymard@u-picardie.fr

Date limite d'Envoi des résumés: 02 avril 2001

IMPORTANT: Les frais d'inscription ne comportent pas l'adhésion au RFM au titre de l'année 2001. Pour participer aux JRFM2001, il est impératif d'envoyer votre cotisation de 100 Frs. à l'ordre du RFM (pour tout renseignement complémentaire sur cette adhésion contacter E. Gaffet)

UNITED ENGINEERING FOUNDATION

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Tel.: +1-212-591-7836 Fax: +1-212-591-7441

engfnd@aol.com **www.engfnd.org**

General Information and Call for Abstracts

Novel Synthesis and Processing of Nanostructured Coatings for Protection Against Degradation

August 12-17, 2001

Davos, Switzerland

This conference will concentrate on processing and properties of coatings and bulk nanostructured materials, spanning all areas from fundamental research to final industrial application. The organizers aim to bring together researchers, engineers and industrialists from around the globe in an informal, yet intensive setting to discuss this important field.
Special attention will be given in the conference to minimize the gap between academic research and industry on this promising and novel field in materials science. Discussion will specifically address the possible and current application of nanostructured materials in a bulk or coating form (not excluding the fundamental research in this field), process development and properties characterization of functional nanostructured systems.
The conference is co-sponsored by the Office of Naval Research.

Conference Organization

Enrique J. Lavernia, Ph.D., Professor and Chair, Dept. of Chemical and Biochemical Engineering and Materials Science and Dept. of Mechanical and Aerospace Engineering, University of California Irvine -- Irvine, CA 92697-2575. Tel: 1-949- 824-8714; Fax: 1-949- 824-2262; E-mail: lavernia@uci.edu
Christopher C. Berndt, Ph.D., Professor, SUNY at Stony Brook, Dept. of Materials Science and Engineering, 306 Old Engineering Bldg., Stony Brook, NY 11794-2275. Tel: 1-631- 632-8507; Fax: 1-631- 632-8525/ 632-8052, E-mail: cberndt@notes.cc.sunysb.edu
Julie M. Schoenung, Ph.D., Associate Professor, Department of Civil and Environmental Engineering University of California Irvine, Irvine, CA 92697. Tel: 1-949-824-5333; Fax: 1-949-824-2117; Email: jmschoenung@csupomona.edu
Dr. **Horst Hahn**, Professor and Head, Thin Films Division, Institute of Materials Science, Darmstadt University of Technology Petersenstr. 23, D-64287 Darmstadt, Germany
E-mail::hhahn@hrzpub.tu-darmstadt.de
Lawrence Kabacoff, Ph.D., Scientific Officer, Office of Naval Research, 800 N. Quincy Street Code 332FM, Arlington, VA 22217-5660. E-mail: kabacol@onr.navy.mil

Organizing Committee Membership
Prof. Bernard Kear **(Rutgers University, USA), Prof.** Richard Siegel **(Renssalear Polytechnic Institute, USA), Dr.** Stephan Siegmann **(EMPA - Swiss Federal Laboratories for Materials Testing & Research, Thun, Switzerland), Dr.** Christian Moreau **(National Research Council, Canada), Dr.** Michel Trudeau **(Hydro-Quebec Research Institute, Canada),** George Kim **(PyroGenesis, USA);** Mostafa Talukder **(ONR-Japan Office); Dr.** Gerardo Trapaga **(CINVESTAV-IPN, Mexico); Dr.** Hideaki Matsubara **(Japan Fine Ceramics Center).**

Submission of Abstracts for Papers and Posters
All interested authors are invited to submit papers and posters for this conference. Manuscripts corresponding to oral presentations (the oral presentations should not exceed **30 minutes** so as to leave sufficient time for discussion) as well as selected poster presentations will be published in a peer reviewed journal which will be provided to all conference participants.

The deadline for submission of a one-page abstract is February 28, 2001. Abstracts should be submitted to www.engfnd.org. *Everyone who submits an abstract must also send a conference application to the Engineering Foundation.* Authors will be notified of the status of their paper by March 15, 2001. Selection for the final program will be made on the basis of the abstracts.

The hardcopy of the final manuscripts and a disc-copy should be brought to the conference and handed to the organizers.

United Engineering Foundation Conference Fellowship Program
The United Engineering Foundation sponsors a Conferences Fellowship Program. Applicants are limited to those currently active in engineering or related professions with a direct interest in the conference topic. They must be within ten years of their first professional degree at the time their application is submitted. The stipend is sufficient to cover the conference registration fee and on-site room and board. Transportation expenses are not included. Application information may be obtained by fax from UEF or on WWW (http://www.engfnd.org).

United Engineering Foundation Conferences Program
The United Engineering Foundation Conferences Program was established in 1962 to provide an opportunity for the exploration of problems and issues of concern to engineers and scientists from many disciplines. The format of the Conference provides morning and (some) evening sessions in which major presentations are made. Available time is included during the afternoons for *ad hoc* meetings, workshops and informal discussions and is designed to enhance rapport among participants and promote dialogue on the developments of the meeting. We believe that the conferences have been instrumental in generating ideas and disseminating information to a greater extent than is possible through more conventional forums. All participants are expected to participate actively in the discussions.

Davos Conference Center and Cresta Sun Hotel
The conference will be held at the Davos Conference Center, the same venue that hosts the annual World Economic Forum. The Congress Center has complete conference facilities and ample room for poster sessions. Conference participants will be housed at several hotels (Cresta Sun, Cresta and Kongress) close to each other (50 meters) and close to the Conference Center. All participants will enjoy meals together at the Cresta Sun Hotel.

L A C A M E ' 2 0 0 2

EIGTH LATIN AMERICAN CONFERENCE ON APPLICATIONS OF THE MÖSSBAUER EFFECT

PANAMA, 22-27 SEPTEMBER, 2002.

First Announcement and Call for Papers

The Latin American Conference on Applications of The Mössbauer Effect, LACAME, belongs to a series of biennial conferences aiming at providing participants with significant and up-to-date Mössbauer Spectroscopy results from the Latin American groups and to stimulate the exchanges with specialists from different parts of the world. The event includes the participation of specially invited lecturers communicating significant recent developments in Mössbauer Effect research.

We are pleased inviting you to attend the eight edition, **LACAME'2002**, which will be held in Panama City, Panama between 22 – 27 September 2002.

Congress Plan
The congress will consist of plenary lectures, oral and poster presentations, and technical exhibitions. Furthermore, a full social program will be scheduled, to ensure that delegates enjoy some of the attractive characteristics of the country, like the Panama Canal. The official languages of the congress will be Spanish, Portuguese, and English. Nevertheless, abstracts, and papers must be in English.

List of topics
T1. Applications of Mineralogy: Archeology, Geology and Soils Studies
T2. Amorphous, Nanocrystalline and Small Particles.
T3. Chemical Applications, Structure and Bonding
T4. Corrosion and Catalysis.
T5. Experimental Techniques and Data Processing
T6. Magnetism and Magnetic Materials
T7. Physical Metallurgy and Materials Science
T8. Other Topics

Call for Papers
People wishing to present papers should submit titles and abstracts along with their complete address and affiliation. The majority of contributions will be presented as posters, although your preference will be taken into account. All the papers, which are offered for presentation at the congress, will be refereed at first on the basis of the abstracts. The abstracts will be reproduced in the 'Book of Abstracts', distributed during the conference. Abstracts are requested in Microsoft Word, WordPerfect or Rich Text format and follow the form outlined below.
The abstracts should be send via e-mail attachment to
lacame@ancon.up.ac.pa

Proceedings
The conference proceedings will be published by Hyperfine Interactions and will include all oral and poster presentations. Authors will be asked to submit a manuscript in a specified form.

Best Thesis Award
According to a decision of last LACAME meeting, the best contribution based on a Thesis work done in a Latin American country and presented by the student during the conference will be selected to receive the award for Best Thesis of the Conference. Election will be based on the scientific merits, significance of the use of the Mössbauer Effect, and the quality of presentation. The award will be announced in the Closing Session. The persons interested in participating should inform so to the Organizing Committee.

Important dates

Second Announcement (Abstract Info. and Additional Info.)	January, 2002
Deadline for submission of abstracts	May 24, 2002
Notification of Paper Acceptance and Presentation Format	July 1, 2002
Third Announcement (Program Schedule)	July 22, 2002
Deadline for lower registration fees	July 29, 2002
Deadline for housing reservations	August 19, 2000
Conference starts	September 22, 2002
Deadline for receipt of contributed manuscripts	September 23, 2002

Letter of Invitation
On request, the Conference Organizing Committee will be pleased to send personal invitations to participants of **LACAME´2002**. Such invitations are only for the purpose of assisting participants to raise travel funds or to obtain a visa. No financial commitment on the part of the organizers is implied.

Additional information
Registration, social program, hotel accommodation, and tourist information details will be provided latter.
Registration
The registration fee for **LACAME'2002** will be US$ 300 for scientific participants if paid by July 29th, 2002. The fee after this date will be US$ 450.
The fee for students and accompanying persons will be US$ 150 July 29th, 2002 and US$ 225 after this date.
The registration fee covers attendance to all sessions of the Conference and some programmed social events, the book of abstracts and refreshment during conference breaks.

Committees
Organizing Committee

J.A. Jaén Chair	(Universidad de Panamá)
A. Foti de Bósquez	(Universidad de Panamá)
C. Garrido	(Universidad de Panamá)
M. Sánchez de Villalaz	(Universidad Tecnológica de Panamá)
E. García de Saldaña	(Universidad de Panamá)
E. Chung	(Universidad de Panamá)
C. Hernández	(Universidad Tecnológica de Panamá)

Latin American Comittee

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V. Peña	(Perú)
R.C. Mercader	(Argentina)
G.A. Pérez	(Colombia)
F. González-Jiménez	(Venezuela)

Proceedings Committee
J.A. Jaén
E. Baggio Saitovich
R.C. Mercader
G.A. Pérez
R. Gancedo
F. González-Jiménez
Contact address
Electronic communication with the local Organizing Committee is preferred. All the correspondence concerning this event should be addressed to:

Dr. Juan A. Jaén – LACAME´2002
Departamento de Química
Facultad de Ciencias Naturales, Exactas y Tecnología
Universidad de Panamá
Panamá
Phone: (507) – 223-6575 ext. 2105, Fax: (507) 263-7636
E-mail: **lacame02@ancon.up.ac.pa**
http://www.up.ac.pa/Eventos/lacame2002/inicio.htm

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Annonce de congres et / Ou Ecoles
Congress and School Announcements

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Mossbauer E-Missions 01-02:
ICAME2001 Student Travel Scholarships

The ICAME 2001 Organizing Committee is providing a limited number of $1,200 U.S. and Canadian student travel scholarships to attend the 2001 International Conference on the Applications of the Mossbauer Effect (ICAME2001) to be held 2-7 September, 2001, in Oxford, England. The deadline for submitting an application for a travel scholarship is April 1, 2001. Award recipients will be notified by May 1, 2001. AWARDS ARE MADE ONLY TO THOSE STUDENTS TRAVELLING UNDER U.S. OR CANADIAN PASSPORTS. If you are interested in receiving application information, please visit our Web site at: http://www.unca.edu/medc or contact: Prof. John G. Stevens - Mossbauer Effect Data Center - University of North Carolina at Asheville - One University Heights, CPO #2311 - Asheville, NC 28804-8511 - United States - E-mail: mailto:stevens@unca.edu - Fax: +1-828-232-5179

Journées Annuelles 2001 du GFC
Ecole des Mines de St Etienne
22 / 22 Mars 2001
Thèmes prévus :
Corrosion - Filtration - Tribologie - Capteurs
Contacts : B. Guilhot et F. Thévenot
Ecole Nationale Supérieure des Mines de St Etienne
158 Cours Fauriel
42023 - St Etienne Cedex
E_Mail : mailto:Thevenot@emse.frou mailto:BGuilhot@emse.fr
Rmq : Propositions de communications avant le 15 Janvier 2001

Science et Technologie des Poudres
Nancy - France
3 - 5 Avril 2001
website : http://www.inpl-nancy.fr/stpoudres3.html
e_Mail : mailto:stpoudres@inpl-nancy.fr

Australian Workshop on Nanotubes and Fullerenes

Australian National University, Canberra,
Mai 3- 4, 2001

Scope
Fullerenes, nanotubes and related nanomaterials are receiving great interest due to the new properties and to potential application in various fields. A workshop is designed to bring together research scientists and engineers working in various disciplines in the broad area of nanotube and Fullerene -related materials and to provide an opportunity to exchange new ideas and results. Students are encouraged to attend with free registration.

Topics
Thermodynamics and Modeling, Synthesis and Processing, Characterization, Properties and Applications

First announcement and call for paper
Send your abstracts and registration by e- mail attachment to mailto:awnf200@ anu. edu. au. Abstract format and registration form can be found at: http:// rsphysse. anu. edu. au/ nanotube/ awnf2001/
For more information please contact Dr Ying Chen, Department of Engineering & Research School of Physical Science and Engineering, The Australian National University, ACT 0200.
Ph: 61 02 62490380, Fax: 61 02 62798338,
E- mail: mailto:ying. chen@ anu. edu. au.

Partial list of invited speakers:
Prof. D. Tomanek, MSU, USA Prof. G. Wallace, University of Wollongong
Prof. H. M, Cheng, IMR, CAS, China Dr. L. M. Dai, CSIRO
Prof. M. Wilson, UTS

PM2 TEC2001
2001 International Conference on Powder Metallurgy
& Particulate Materials
13 - 17 Mai 2001 - New Orleans - USA
Contact : MPIF

JRFM'2001
21 et 22 Mai 2001 - Amiens - France
Thème : Influence de la mécanosynthèse sur les propriétés physico - chimiques des matériaux
Contact : Luc.Aymardsc.u-picardie.fr
ou mailto:Eric.Gaffet@utbm.fr

7th International Symposium on Agglomeration
29, 30, 31 May 2001
Albi - France
Website : http://www.univ-inpt.fr/~agglom
or http://www.enstimac.fr/

ISMANAM2001
University of Michigan, Ann Arbor, Michigan, USA
Ann Arbor, Michigan, 24-29 June, 2001
http://www.ners.engin.umich.edu/ISMANAM2001
Abstract deadline is March 1st, 2001.
Abstracts of 200-400 words should be submitted by e-mail to
E_Mail : mailto:ISMANAM-2001@umich.edu

COLLOQUE SUR LES INNOVATIONS
DANS LES MATERIAUX FRITTES
Poitiers-Futuroscope
3-4-5 juillet 2001
consulter le site http://www.sf2m.asso.fr/(rubriques sommaires puis conférences)

International Conference on the Applications of the Mossbauer Effect
Oxford, UK
2-7 September 2001
Abstracts are now invited for for the above meeting, which is the next in the ICAME conference series. You are asked to submit your abstract via the conference website http://www.iop.org/IOP/Confs/ICAME/ by no later than 1 April 2001.
For further information or enquiries please contact the Conference Office at the Institute of Physics, 76 Portland Place, London W1B 1NT, UK.
E-mail should be directed to: mailto:rebecca.chapple@iop.org

International Conference
"FUNDAMENTAL DASES of MECHANOCHEMICAL TECHNOLOGIES"
Novosibirsk, Russia, August 16-18, 2001
Contact: Prof. N. Lyakhov
Institute of Solid State Chemistry
E-mail: mailto:Conf@solid.nsc.ru
Fax: +7 3832 32 28 47
The first circular is available on WEB-Site of the Institute:
http://www.solid.nsc.ru/

(IPCM 2001)
La 7eme conference internationale sur les phenomenes d'interface dans les materiaux composites (IPCM 2001) se tiendra au palais des congres d'Arcachon (40 km de Bordeaux) du 11 au 14 septembre 2001.
http://www.arcachoncongres.com/ipcm2001/

(IWSIS-3)
October, 7-12, 2001.
3rd International Workshop on Surface and Interface Segregation , Island of Porquerolles, French Riviera,
This Workshop is devoted to the study of the segregation phenomenon in defects of crystallized solids (surface, grain boundary, interface of interphase...)
INFOS : http://www.crmc2.univ-mrs.fr/confs/iwsis

L A C A M E ' 2 0 0 2

EIGTH LATIN AMERICAN CONFERENCE
ON APPLICATIONS OF THE MÖSSBAUER EFFECT
PANAMA, 22-27 SEPTEMBER, 2002.E-mail: **Erreur! Signet non défini.**
http://www.up.ac.pa/Eventos/lacame2002/inicio.htm

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SOUTENANCES DE THESE
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T. Ziller

Etude du Mélange à l'Etat Solide lors de la mécanosynthèse d'alliages Fe - X

(X = Cr, Mn, V, Mo) et Etude de la mise en ordre d'alliages Fe - V élaborés par cette Technique

INPL - Ecole des Mines de Nancy
22 Décembre 2000
Jury : J. Foct (Pdt), E. Gaffet (Rapp.), JF Dinhut (Rapp.), L. Chaffron, O. Isnard, G. Le Caer (Dir.)

Th. Grosdidier

Habilitation à Diriger des Recherches

20 Décembre 2000 à 10h00, salle de conseil de l'ISGMP – Ile du Saulcy

LETAM (UMR 7078), Université de Metz.

Jury : Rapporteurs : Pr. Elisabeth Gautier, Pr Jacques Foct, Pr. Günter Gottstein, Pr. David G. Morris - Examinateurs : Pr. Marie-Jeanne Philippe, Pr Panos Tsakiropoulos, Pr. Francis Wagner.

V. Gauthier

Elaboration et réactivité à hautes températures du composé intermétalliques $NbAl_3$.

Influence du mode de préparation sur le processusd'oxydation

Dijon - 18 Décembre 2000

Jury : G. Bertrand (Pdt), F. Nardou (Rapp.), M. Vilasi (Rapp.), E. Gaffet, F. Bernard, J.P. Larpin

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A. C. Sekkal

Etude des Transformations Tribologiques de Surfaces

ou TTS induites par impacts à énergie controlée

Ecole Centrale de Lyon
5 Décembre 2000
Jury : Esnouf Claude (Pdt) - Gaffet Eric (rapp.) - Georges Jean Marie (Rapp.) - Inglebert Geneviève Langlade-Bomba Cécile - Lucuru Daniel - Vannes A.Bernard

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N. LORRAIN

Poudres Nanocomposites Ag - SnO2 préparées par broyage réactif : mise en oeuvre, frittage et évolution microstructurale

30 Octobre 2000 - Université de Grenoble I
Jury : E. Gaffet (Rapp.), F. Thévenot (Rapp.), D. Bouvard, G. Le Caër, C. Carry (Dir. Thèse), L. Chaffron

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J.Ph. BRAGANTI

Synthèse d'alliages amorphes Al-Ni-Zr par broyage mécanique :
- étude de la cinétique de cristallisation par calorimétrie,
- analyse du chemin réactionnel par diffraction des rayons X

20 octobre 2000 – Université Henri Poincaré – Nancy I – Vandoeuvre lès Nancy
Jury : C. Bergman (Rapp.), J.P. Bros (Rapp.), J.M. Moreau, S. Colin-Bégin, J.C. Gachon, F.A. Kuhnast (Dir)

M. Nakhl

Le broyage énergétique appliqué à :
l'obtention de mélanges composites à base de magnésium utilisables pour le stockage de l'hydrogène,
la modification des propriétés magnétiques d'intermétalliques à base de gadolinium

16 Octobre 2000 - Université de Bordeaux I - Bordeaux

Jury : G. Le Caër (Rapp.), E. Gaffet (Rapp.), B. Chevalier, J.-L. Bobet, J. Etourneau

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Ch. Gras

Réactivité et Thermodynamique dans le procédé MASHS
(Mechanically Activated Self - Propagating High - Temperature Synthesis) :
Application aux systèmes Mo / Si et Fe / Si
6 Septembre 2000 - Univ. de Bourgogne - Dijon

Corresp. : mailto:Eric.Gaffet@utbm.fr

Jury : Y. Bienvenu (Rapp.), G. Le Caer (Rapp.), G. Bertrand, JP Bonnet, M. Gailhanou, JP Larpin, F. Bernard (Co - directeur) & E. Gaffet (Co - Directeur)

M. Zouggar

"Effets du broyage sur les propriétés structurales et mécaniques de poudres de fer pur et sur l'activation de la nitruration"

4 Septembre 2000 - LMP - Poitiers

Jury : A. Fnidiki(Rapp.), E. Gaffet (Rapp), P. Goudeau (Inv.), M. Grosbras (Inv.), A. Straboni , P. Chartier (Co - Dir) & J. Mimault (Co - Dir)

C. Goujon

"Elaboration par cryobroyage et métallurgie des poudres de nanocomposites à matrice d'alliage d'aluminium renforcée par des particules de nitrure d'aluminium"

25 Mai 2000 - ENSMSE

Jury : P. Goeuriot (Dir. Thèse), G. Le Caer (Rapp.), D. Michel (Rapp.), F. Bernard, Y. Laurent, M. Suery, F. Thévenot, S. Vicens

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J. Joardar

"Synthesis of nanocrystalline aluminides in Al - Ni - Fe system by Mechanical Alloying"

Avril 2000

Thesis Supervisor : B.S. Murty et S.K. Pabi (IIT, Kharagpur)

Thesis Examiners : C.C Koch (North Carolina State University) , P. Ramakrishnan (IIT, Bombay)

Christine Barbeau

(Laboratoire de Métallurgie Physique - Futuroscope)

Sructure dans les matériaux élaborés sous HIP : cas des alliages à base tungtène par frittage et du carbure de titane par combustion auto-propagée

13 mars 2000

Thèse de Doctorat de l'Université de Poitiers

Jury: A. TRAVERSE,(Rapporteur) - F. NARDOU (Rapporteur), D. VREL, M.F. BEAUFORT, M. GROSBRAS, J. MIMAULT(Directeur de Thèse)

Hugues GUÉRAULT

PROPRIÉTÉS STRUCTURALES ET MAGNÉTIQUES DE POUDRES DE FLUORURES NANOSTRUCTURÉES MF3 (M=Fe, Ga)

OBTENUES PAR BROYAGE MÉCANIQUE

28 Janvier 2000

THèSE DE DOCTORAT - Université du Maine - Physique des Matériaux et des Surfaces

Jury : Gérard Le CAER,(Rapporteur), Marc NOGUES, (Rapporteur), Jean-Franÿois BÉRAR, Frédéric BERNARD, , Jean-Yves BUZARÉ, , Marc LEBLANC, Jean-Marc GRENèCHE (Directeur de thèse)

Cyril Lenain

APPLICATION DE LA MECANOCHIMIE A LA PREPARATION D'ALLIAGES HYDRURABLES NANOCRISTALLINS AB5, MG-NI, AB2 (M) ET DE COMPOSITES M-C, M-Cu : ETUDE DE LEURS PROPRIETES ELECTROCHIMIQUES.

THESE DE DOCTORAT - Specialite: sciences des matriaux presentee a l'Universite de Picardie Jules Verne

Jury : J. Etourneau, M. D. Fruchart, A. Percheron - Guegan, L. Schlapbach, J-M. Tarascon, M. L. Aymard

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Cooperative Research on Related Areas

****

COREE du SUD (19/01/2000)
From Professor Soon H. Hong
Dept. of Materials Science and Engineering - Korea Advanced Institute of Science and Technology
373-1 Kusung-dong, Yusung-gu - Taejon, 305-701, Korea
E-mail : shhong@sorak.kaist.ac.kr / shhong@sorak.kaist.ac.kr
Fax. : 82-42-869-3310 - Tel. : 82-42-869-3327
We are currently working on the mechanical alloying processes and the characterization of mechanical & thermal properties of nanocrystalline materials and composite materials, such as SiC/Al, WC/Co and W/Cu for structural or thermal management applications. We are very pleased to discuss for international cooperative research on related topics with Members of Mechanosynthese Group.

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Job Vacancies, Ph D Position and Post Doc Position Requests – Proposals

From B. Mhohamed – UK – (10/01/2001)
Marie Curie Training Fellowships
Applications are invited for 3-12 month research fellowships supported by the Marie Curie Training Sites scheme. The successful candidates will be involved with the processing of alloys, intermetallics, nanostructures, or composites for high-temperature, biomedical and/or energy-storage applications. Processing techniques and facilities include ball milling, mechanical alloying, reaction synthesis, tape casting, slurry powder metallurgy, and vacuum cold/hot pressing. Materials characterisation will be carried out by TG/DTA, DSC, MS, optical microscopy, X-Ray, and SEM/TEM techniques. Complementary modelling activities for materials-design, processing, microstructural evolution, and/or property predictions may also by involved as part of the fellowship training programme. Modelling methodologies range from *ab initio* atomistic simulations to finite-element methods. The candidates must satisfy the basic criteria of the training scheme as outlined under http.//www.cordis.lu/improving. As the fellowship forms part of a higher degree project, the candidates should be a registered full-time PhD research student in a well-recognised institution, working on materials synthesis, characterisation, and/or computer modelling of materials, of an EU nationality (non-UK) and under 35 years of age. Deadline for application: 30 February 2001.
For further details, please contact: Professor Z. Xiao Guo, phone: 0044-20-7882-5569; e-mail: x.guo@qmw.ac.uk; or visiting: http://www.metallicmaterials.com/.
QMW / University of London is an equal opportunity employer.
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From A.R. Yavari - France (8/01/2001)
EU Postdoc/Ph.D. positions in fields of Nanostructured Materials and Bulk Metallic Glasses are available immediately in France and several other EU States. Please check the following web page
http://www.inpg.fr/BMG-RTN/
and contact the Coordinator A.R. Yavari at mailto:euronano@ltpcm.inpg.fr
****

From Dr. Jürgen Eckert Allemagbe (11/2000
Ph D or Post Doc Position
We are looking for a PhD candidate / Postdoc to start as soon as possible in the framework of an European RTN network on bulk metallic glasses and nanostructured materials.
Dr. Jürgen Eckert
IFW Dresden - Institut für Metallische Werkstoffe
Postfach 27 00 16 - D-01171 Dresden -Germany
>Tel.: +49 (351) 4659-602/-324
>Fax: +49 (351) 4659-541
>E-mail: mailto:j.eckert@ifw-dresden.de
****

Espagne (25/09/2000) POSTDOCTORAL POSITION (From M.D. Baro)
Universitat AutÚnoma de Barcelona
The Group de Fisica de Materials II of the Physics Department of the UAB announces the availability of a 18 months full-time Postdoctoral Research position. Applicants should hold a PhD degree in Materials Science, Physics or in a related field.
The position requires:
Knowledge of glasses, metastable and nanocrystalline materials.
Fundamental understanding of the nucleation and crystal growth theories.
Knowledge of calorimetry and thermostability.
Experience in electron, optical and x-ray based characterisation techniques and practices.
Computer literacy.
Citizenship of EU (except Spain) or Associated states.
Under 35 years old.
Proficient level of English
The position begins with effect from January 2001. The research programme includes a close co-operation with other

partners of the Project. Applicants should submit a CV, and a statement describing your interest in the position with two references to:
Professor M.D. Baro,
Dept. Physics, Edifici Cc,
08193 Bellaterra, Barcelona, Spain; Tel: 34 93 5811657. Electronic applications can be sent to mailto:dolors.baro@uab.es"
****

Angleterre (21/09/2000) - From Paul Warren (paul.warren@materials.oxford.ac.uk)
Job vacancies in a Research Training Network.
Research Training Network on Manufacture and Characterisation of Nanostructured Al alloys
Pre-doctoral/post-doctoral researchers required at 9 institutions across Europe.
The research positions will involve aspects of : materials processing by gas atomization, rapid solidification and mechanical alloying, followed by compaction; microstructural and microchemical characterisation by XRD, DSC, TEM, STEM, APFIM ; thermodynamic / kinetic modelling and molecular dynamic simulation ; mechanical property evaluation by tensile testing, fatigue testing and high strain rate impact testing.
See Network Homepage http://www.materials.ox.ac.uk/nano-al/for more details.

Bibliographie Récente

Livres ou "Special Issues"

(11/2000) Information from Fritsch (A. Kohler)
The subject of the sixth forum part Fritsch Forum Part VI scheduled for September 14/15th, 2000, will be "high-energy fine grinding". Research and Development demand general-purpose grinding processes which simultaneously exactly define the required energy and the type of stress. This is the only way that reliable results can be achieved when determining activation energies or the mechanical alloying. It must be possible to reproducibly adjust all of the grinding parameters affecting the grinding results.
Participants from research, development and industry will report on demands and novel technological solutions in developing innovative milling technologies. One of the highlights of the event will be FRITSCH's new Vario-planetary mill "pulverisette 4". This planetary ball mill can simulate ball mills of conventional construction, precisely copy the types of stresses that occur there, and thus reproduce or optimise grinding processes. Due to the great flexibility when selecting the grinding parameters, it is possible to produce results that are unattainable with other ball mills. It is the ideal mill for mechanical activation and alloying. The main applications are in the area of material research and naturally wherever a powerful, innovative laboratory planetary mill is needed.
An extensive report has been written about this event which details and makes readily available the relevant parts of the lectures and the extensive results of the discussions. Anyone interested can request a copy of the complete report for this forum part VI event on the topic "high-energy fine grinding". Please contact Andrea Köhler, FRITSCH GMBH, Industriestrasse 8, D-55743 Idar-Oberstein, (Phone: 0049/6784/7046, E-Mail: koehler@fritsch.de)

(7/07/2000) - From Victor Riecansky Publisher
Cambridge International Science Publishing http://www.demon.co.uk/cambsci/homepage.htm
MACROMOLECULAR MECHANOCHEMISTRY
Volume 1: Polymer Mechanochemistry - by Cleopatra Vasiliu OPREA & Florin DAN
Department of Macromolecules, Gh. Asachi, Technical University, 6600 Iasi, Romania
Macromolecular Mechanochemistry presents from theoretical and experimental point of view the main problems of this field, including the results obtained in more than a century of research. It is organised in two volumes: Polymer Mechanochemistry and Polymers with Chemomechanical Functions, respectively. The present volume deals with: Chained Polystage Character of Mechanochemical Process (1), Mechanochemistry of Polymers Deformation (2); Mechanochemistry of Polymer Fracture (including also the Fracture of Composite Materials) (3), and Mechanochemical Processes for Energy Conversion (4). In this frame, the theoretical and experimental material is organised in correlation to the reaction mechanism, the type of mechanical solicitation, and the nature of environmental medium. This book is addressed to professors, students, and researchers involved in the field of polymer science, to engineers from the industry of synthesis and processing of plastic materials, elastomers and fibres, as well as to specialists from all technical domains that exploit polymer-based materials. They will find in the book examination of the theoretical, experimental and applied problems and wide access to the basic literature in this field. Contents
1. Chained polystage mechanism of mechanochemical processes
2. Mechanochemistry of polymers deformation
3. Mechanochemistry of Polymer Fracture
4. Mechanochemical Processes for Energy Conversion

Volume 1 (ISBN 189832672X) will be published in September 2000, approx. 500 pages, cased,
approximate price £80.00; (volume 2 will be published at the end of - 2000)
Send your preliminary order to mailto:orders@cisp.demon.co.uk

(9/06/2000)
"Mechanical Alloying : FABRICATION OF ADVANCED MATERIALS AT ROOM TEMPERATURE" by M. Sherif El-Eskandarany
(ISBN: 977-299-089-7) Published by DAR AL-FIKR AL-ARABI, Cairo-Egypt.
The price of the book is $50, and a special discount (20%) is offered to all the RFM member.
Preface
Mechanical alloying (MA) process using ball-milling and/or rod-milling techniques, has received much attention as a powerful tool for fabrication of several advanced materials, including equilibrium, nonequilibrium (e.g., amorphous, quasicrystals, nanocrystalline, etc.), and composite materials. In addition, it has been employed for reducing some metallic oxides by milling the oxide powders with metallic reducing agents at room temperature. The MA is unique process in that a solid state reaction takes place between the fresh powder surfaces of the reactant materials at room temperature. Consequently, it can be used to produce alloys and compounds that are difficult or impossible to be obtained by the conventional melting and casting techniques.
This book intended primarily to serve as an introduction to the MA process, including general description of the process, starting material requirements, the equipment, characterizations of the milled powders, and consolidation techniques, which used to compact the powder into fully-dense bulk materials.
The book contains several typical examples of selected advanced materials that have been fabricated by MA. This book is aimed at either senior undergraduate/post graduate students or materials scientists/metallurgists. - M. Sherif El-Eskandarany - April 2000 - Cairo - EgyptContents -
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Systems and Applications - Amorphous Austenitic Stainless Steel 254 - Fabrication of amorphous Fe52Nb48 Special Steel 257 - Fe-Zr-B 259 - Difference between Mechanical Alloying and Mechanical Disordering in the Amorphization Reaction of Al 50Ta50 in a Rod Mill - Mechanically Induced Cyclic Crystalline-Amorphous Transformations During Mechanical Alloying - References 295 -

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(05/05/2000)
Extractive Metallurgy of Activated Minerals
included in series Process Metallurgy, 10
by P. Balaz - Institute of Geotechnics, Slovak Academy of Sciences
ISBN : 0 - 444 - 50206 - 8 / Price USD 144, Euro 124.79)
file:///http / // www.elsevier.nl/inca/publication
Description
Mechanical activation of solids is a part mechanochemistry, the science with a sound theoritical foundation exhibiting a wide range of potential application. Mechanical activation istself is an Innovative procedure where an improvement in technological processes can be attained via a combination of new surface area and defects formation in minerals.
Mechanical activation is o exceptional importance in extractive metallurgy and mineral processing and this area forms the topic of this book and is a result of more than twenty years of research and graduate teaching in the field.
In pyrometallurgy, the mechanical activation of minerals makes it possible to reduce their decomposition temperatures or causes such a degree of disordering that the thermal activation may be omitted entirely. The potential mitigation of environmental pollutants is becoming increasingly important in this context.
The lowering of reaction temperatures, the increase of the rate and amount of solubility, preparation of water soluble compounds, the necessity for simpler and less expensive reactors and shorter reaction times are some of the advantages of mechanical activation in hydrometallurgy. The environmental aspects of these processes are particularly attractive.
Several industrial processes are examined and the flowsheets are presented as successfull of activation. In these processes, the introduction of a mechanical activation step into the technological cycle significantly modifies the subsequent steps.
The book is designed for researchers, teachers, operators and students in the areas of extractive metallurgy, mineral processing, mineralogy, solid state chemistry and materials science. It will encourage newcomers to the mechanochemistry to do useful research and discover novel applications in this field.

(3/02/2000)
Two new books on mechanical alloying are now available from Cambridge International Science Publishing (infos fournies par Anne Porter - Publishing Manager - Cambridge International Science Publishing http://www.demon.co.uk/cambsci/homepage.htm)
1. MECHANICAL ALLOYING - FUNDAMENTALS AND APPLICATIONS http://www.demon.co.uk/cambsci/book52.htm
Contents
Introduction (history, benefits of mechanical alloying); Mechanical alloying (alloying mills, mills in practice, improved mills, the process, parameters);
Variations of mechanical alloying (reaction milling, cryomilling, repeated rolling, double mechanical alloying, repeated forging); Process control agents in mechanical alloying; Mechanical alloying mechanisms (ductile-ductile system, ductile-brittle system, brittle-brittle system, metastable phase formation, amorphisation, nanocrystallization, extension of solid solubility, activation of solid state chemical interaction);
Energy transfer and energy maps;
Consolidation of mechanically alloyed powders (consolidation techniques, thermomechanical treatment); Mechanical

properties of mechanically alloyed materials (tensile properties, fracture, creep, stress corrosion cracking susceptibility); Modelling mechanical alloying (mechanistic models, deformation, coalescence and fragmentation, evolution of particle size, milling time, powder heating, powder cooling, atomistic model, thermodynamic and kinetic model) Joining of mechanically alloyed materials; Rapid solidification and mechanical alloying; Applications (nickel-based superalloys, Al-based materials, supersaturated solutions, magnetic materials, mechanically alloyed powders for spray coatings, superplasticity, tribological materials, composites, amorphous solids, nanocrystalline materials, solid-state chemical reactions, etc). ISBN 1898326568, 160 pages 234?156 mm, cased, £45.00, 1999

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DISPERSION STRENGTHENED ALUMINIUM PREPARED BY MECHANICAL ALLOYING, by M Besterci - http://www.demon.co.uk/cambsci/book51.htm

1. Characteristics of dispersion-strengthened systems 2. Mechanical alloying (kinetics and mechanism of preparation of the Al-C system by mechanical alloying; compaction of powders and heat treatment of compacts;
3. Microstructure and quantitative evaluation of parameters of dispersion-strengthened materials (definition and properties of interparticle distance; experimental possibilities of determination of structural objects; models of heterogeneous structures and their evaluation; simulation of model structures; analysis of the spatial distribution of particles in the Al-Al4C3 material)
4. Static and dynamic mechanical properties (mechanical properties at elevated temperatures; mechanical properties at 20 °C; effect of interface on the mechanical properties; superplastic properties of the system; thermal stability of the system; creep characteristics; creep-fatigue characteristics)
References - ISBN 189832655X, 90 pages, 234?156 mm, soft laminated cover, £25.00, 1999

"Mechanical Alloying : Fundamentals and Applications"
Prof. P.R. Soni (1999) - Cambridge International Science Publishing
web site : http://www.demon.co.uk/cambsi/book52.htm

"Non Equilibrium Processing of Materials"
R.W. Cahn - Elsevier Science - Volume 2 in the Pergamon Materials Series
A large number of technical papers have been published in reviews, monographs and conference proceedings, but have almost always been devoted to a single processing technique. This book, however, covers all the non equlibrium processing methods and their effects in a single volume.
web site : http://www.elsevier.nl/locate/isbn/0080426972

Bulk Amorphous Alloys : Preparation and Fundamental Characteristics
A. Inoue
Materials Science Foundation Vol. 4 - Trans Tech Publications : http ://www.scienen.net
Interest in bulk amorphous alloys has increased rapidly throughout the workd and these materials have now gained a position of great importance in basic science and engineering materials technology bulk amorphous alloys based upon the Zr - Al - Ni - Cu, Zr (Tin,Nb) - Al - Ni - Cu and Zr - Ti - Ni - Cu - Be systems have already achieved wide commercial success as components of various technical accessories ranging from sporting goods to optical instruments.
Here is a state of the art reviews on this new group of materials, uovering all areas of interest, ranging from the synthesis of these special alloys and their fundamental properties, to their engineering characteristics and applications.
This work will therefore be of equal interest to those who wish to become fully acquainted with the subject, and to those who are already actively engaged in the field.

DISPERSION-STRENGTHENED ALUMINIUM PREPARED BY MECHANICAL ALLOYING
Michal Besterci, Institute of Materials Research, Slovak Academy of Sciences, Kosice
In the book, the author describes the theoretical and technological fundamentals of mechanical alloying the Al-C system. Special attention is given to material characteristics, the kinetics and mechanism of mechanical alloying, methods of mixture compaction and heat treatment of compacted parts. Models of dispersoid spatial arrangement, dispersoid evaluation and optimisation and experimental possibilities are discussed. The interpretation of the static and dynamic mechanical properties, especially strength and ductility properties at 20 °C, mechanical properties at elevated temperatures are discussed, with emphasis on the effect of interface, superplasticity, creep and creep-fatigue characteristics. Content
Introduction
1. Characteristics of dispersion-strengthened systems
2. Mechanical alloying (kinetics and mechanism of preparation of the Al-C system by mechanical alloying; compaction of powders and heat treatment of compacts;
3. Microstructure and quantitative evaluation of parameters of dispersion-strengthened materials (definition and properties of interparticle distance; experimental possibilities of determination of structural objects; models of heterogeneous structures and their evaluation; simulation of model structures; analysis of the spatial distribution of particles in the Al-Al4C3 material)
4. Static and dynamic mechanical properties (mechanical properties at elevated temperatures; mechanical properties at 20°C; effect of interface on the mechanical properties; superplastic
properties of the system; thermal stability of the system; creep characteristics; creep-fatigue characteristics)
Index : ISBN 189832655X, 80 pages, 234?156 mm, soft laminated cover, £22.00, January 1999
Cambridge International Science Publishing 7 Meadow Walk, Great Abington, Cambridge CB1 6AZ, England Fax +44 1223 894539; Tel +44 1223 893295 Email: cisp@cisp.demon.co.uk
http://www.demon.co.uk/cambsci/homepage.htm

"Mechanical Alloying"

Auteurs : Li Lü & Man On Lai(National University of Singapore)
Kluwer Academic Publishers
Contents : Preface - Introduction to Mechanical Alloying - Experimental Set - Up - The Mechanical Alloying Process - Formation of New Materials - Characterization of Powders - Densification - Mechanical Properties - Mechanisms of Mechanical Alloying - Modeling of Mechanical Alloying - Index

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"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"
Auteurs : E. Gaffet, S. Begin - Colin, O. Tillement
Editeur : Innovation 128 - 24 Rue du Quatre Septembre - 75002 Paris - France - Fax : 33 1 42 65 47 76
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 a 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 fied 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@cisp.demon.co.uk / Cambridge International Science Publishing http://www.demon.co.uk/cambsci/homepage.htm

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Proceeding du Congrès "Mechanically Alloyed, Metastable and Nancrystalline Materials"- Barcelone (1997)
Editor : M.D. Baro, S. Surinach - Materials Science Forum 269 - 272 (1998)

Corresp. : mailto:Eric.Gaffet@utbm.fr

Périodiques

(Rubrique réalisée grâce aux moyens de la bibliothèque de l'Université de Technologie de Belfort - Montbéliard / UTBM)

[71] EFFECT OF ANNEAL ON MAGNETIC PROPERTIES AND STRUCTURAL STATE OF IRON POWDERS GROUND IN CARBON-RICH MEDIUM

Ul'yanov AI. Gorkunov ES. Zagainov AV. Yelsukov EP. Konygin GN. Dorofeev GA. Lomaeva SF. Arsent'ev NB. - Russian Journal of Nondestructive Testing. 36(9):621-630, 2000

Intense milling of iron powders in a carbon-rich liquid leads to carbonization of powder particles to concentrations of up to several weight percents, alongside the notable reduction in the dimensions of mosaic blocks and formation of a nanocrystalline structure, which results in a lower coercive force of the powder. X-ray and Mossbauer data indicate that Fe-C disordered solid solutions are formed in the regions of mosaic-block boundaries in the process of the powder milling. The anneal forms the Fe3C ordered carbide phase from the disordered solid solution, which raises the coercive force in the powders beyond 100 A/cm

[70] MECHANICAL ALLOYING AND MILLING [REVIEW]

Suryanarayana C. - Progress in Materials Science. 46(1-2):1-184, 2001.

Mechanical alloying (MA) is a solid-state powder processng technique involving repeated welding, fracturing, and rewelding of powder particles in a high-energy ball mill. Originally developed to produce oxide-dispersion strengthened (ODS) nickel- and iron-base superalloys for applications in the aerospace industry, MA has now been shown to be capable of synthesizing a variety of equilibrium and non-equilibrium ahoy phases starting from blended elemental or prealloyed powders. The non-equilibrium phases synthesized include supersaturated solid solutions, metastable crystalline and quasicrystalline phases, nanostructures, and amorphous alloys. Recent advances in these areas and also on disordering of ordered intermetallics and mechanochemical synthesis of materials have been critically reviewed after discussing the process and process variables involved in MA. The often vexing problem of powder contamination has been analyzed and methods have been suggested to avoid/minimize it. The present understanding of the modeling of the MA process has also been discussed. The present and potential applications of MA are described. Wherever possible, comparisons have been made on the product phases obtained by MA with those of rapid solidification processing, another non-equilibrium processing technique.

[69] MECHANOCHEMICAL SYNTHESIS OF ZINC FERRITE FROM ZINC OXIDE AND ALPHA-FE2O3

Kim W. Saito F. - Powder Technology. 114(1-3):12-16, 2001

Mechanochemical synthesis of zinc ferrite (ZnFe2O4) from a powder mixture of zinc oxide (ZnO) and hematite (alpha - Fe2O3) by room temperature grinding using a planetary ball mill was investigated. The grinding enables us to obtain the amorphous mixture of the starting materials. Most of ZnO reacts with alpha -Fe2O3 to convert into insoluble amorphous zinc and iron compounds within 2h-grinding. Prolonged grinding enhances the crystallization of ZnFe2O4 from the amorphous compounds. ZnFe2O4 crystallized by the grinding for 3 h or more consists of nanocrystalline particles with high specific surface area.

[68] INFLUENCE OF MECHANICAL ACTIVATION AND FLUORINE ION ON FORSTERITE FORMATION

Kiss SJ. Kostic E. Djurovic D. Boskovic S. - Powder Technology. 114(1-3):84-88, 2001

The influence of mechanical activation of the mixture basic MgCO3-amorphous SiO2 on reaction of forsterite formation was studied with and without the presence of fluorine ion. Beneficial influence of mechanical activation on the reaction in the mixture without fluorine ion is a consequence of the change of the granulometry during the intense milling. Mechanical activation in the presence of fluorine ion affects the mechanism of forsterite formation via different compounds from the humite group. With non-activated mixture dominant transition phase is hondrodite, while with activated mixture, clinohumite is the transition compound in the process of formation of end reaction products. Fluorine ion is released from the system by hydrolysis.

[67] INTENSIVE GRINDING OF POWDERS IN AN ELECTRO-MAGNETO-MECHANICAL MILL

Binczyk F. Polechonski W. Skrzypek SJ. - Powder Technology. 114(1-3):237-243, 2001

The paper presents the results of high-energy grinding in the electro-magneto-mechanical (EMM) mill. Ground powder is treated in a very specific and intensive way owing to several field forces operating simultaneously in the EMM mill. The grinding power in the centre of the mill's working chamber is in the order of 2 MW/m(3), which is much more than in ordinary mills. Therefore, the grinding time is very short, i.e., several tens of seconds. The self-disintegrated Fe-Al-Si powders of 155 mum on average undergo size reduction to 8 mum after 120 s. Over 25% of the total weight get the size of less than 1.3 mum Very hard materials, such as SiC and B4C reduce their grain size over 30 times after 120 s of grinding in the EMM mill. The results of the grinding of Fe2O3 powder are even better. In ball mills, vibration and planetary mills, similar results can be achieved after a period several hundreds times longer. The treatment of Fe-Al-Si powder presented here is intended as the preparation procedure for sintering, plasma spraying or laser surface alloying.

[66] SUPERPLASTICITY AND PRODUCTION OF MECHANICALLY MILLED TI-6AL-4V-0.5B

Godfrey TMT. Wisbey A. Brown A. Brydson R. Hammond C. - Materials Science & Technology. 16(11-12):1302-1308, 2000

Superplastic forming of conventional titanium alloy sheet is limited commercially by the relatively long cycle times imposed by the high temperatures and slow strain rates required. In order to minimise cycle times material with a fine grain size is required to allow either, an increase in the forming rate or a reduction in the deformation temperature. This study details the manufacture of Ti-6Al-4V-0.5B powder with a nanocrystalline grain size, which was produced by mechanical milling. The material was consolidated by hot isostatic pressing at a range of temperatures during which similar to 2.5 vol.-%TiB was formed by an ill situ reaction between the titanium and boron. The TiB particles limited the growth of the grain size in the titanium from the nanocrystalline structure in the powder to sizes in the range 600 mn-4 mum after consolidation. The consolidated material was hot tensile tested at a range of temperatures and strain rates. A superplastic elongation of 310% was achieved when testing at 900 degreesC at a strain rate of 6x10(-2) s(-1) compared with 220% for conventional Ti-6Al-

4V sheet. However, extensive cavitation, induced by the presence of argon, occurred during high temperature deformation and limited the superplastic extensions achieved. MST/4779

[65] MECHANICALLY ALLOYED METALS

Bhadeshia HKDH. - Materials Science & Technology. 16(11-12):1404-1411, 2000

Mechanical alloying involves the severe deformation of mixtures of powders until they form the most intimate of atomic solutions. Inert oxides can also be introduced to form a uniform dispersion of fine particles which strengthen the consolidated product. Large quantities of iron and nickel base alloys with unusual properties are produced commercially using this process. The theory describing the way in which the powders evolve into a solution is reviewed. There are some fundamental constraints which dictate how the microstructure must change during mechanical alloying for the process to be at all viable. The strange recrystallisation behaviour of the alloys can be understood if it is assumed that unlike normal metals, the grains in the mechanically alloyed sample are not topologically independent. Another topic discussed is the mechanical blending of microstructures containing different phases, both with and without a net reduction in free energy. MST/4799

[64] MECHANICAL AND MICROSTRUCTURAL BEHAVIOUR OF A PARTICULATE REINFORCED STEEL FOR STRUCTURAL APPLICATIONS

Kulikowski Z. Godfrey TMT. Wisbey A. Goodwin PS. Langlais F. Flower HM. Zheng JG. Davies DP. - Materials Science & Technology. 16(11-12):1453-1464, 2000

Low density, high modulus, and potentially improved wear resistance are the major benefits of a ferrous composite material. A BS S.156 (4%NiCrMo) gear steel reinforced with 15 vol.-% titanium diboride particles has been demonstrated for possible high performance structural applications. This composite has been produced by a powder metallurgy/mechanical milling processing route,to give a homogeneous distribution of fine reinforcement particles. The composite tensile strength was 90% of the matrix in the fully heat treated condition, with ductility of up to 6%, However, martensite formation and hence the hardenability was found to be suppressed in the composite. A fatigue study indicated that the titanium diboride particles did not appear to contribute to crack initiation in the composite. MST/4531

[63] FABRICATION PROCESS AND THERMAL PROPERTIES OF SICP/AL METAL MATRIX COMPOSITES FOR ELECTRONIC PACKAGING APPLICATIONS

Lee HS. Jeon KY. Kim HY. Hong SH. - Journal of Materials Science. 35(24):6231-6236, 2000

The fabrication process and thermal properties of 50-71 vol% SiCp/Al metal matrix composites (MMCs) for electronic packaging applications have been investigated. The preforms consisted with 50-71 vol% SiC particles were fabricated by the ball milling and pressing method. The SiC particles were mixed with SiO2 as an inorganic binder, and cationic starch as a organic binder in distilled water. The mixtures were consolidated in a mold by pressing and dried in two step process, followed by calcination at 1100 degreesC. The SiCp/Al composites were fabricated by the infiltration of Al melt into SiC preforms using squeeze casting process. The thermal conductivity ranged 120-177 W/mK and coefficient of thermal expansion ranged 6-10 x 10(-6)/K were obtained in 50-71 vol% SiCp/Al MMCs. The thermal conductivity of SiCp/Al composite decreased with increasing volume fraction of SiCp and with increasing the amount of inorganic binder. The coefficient of thermal expansion of SiCp/Al composite decreased with increasing volume fraction of SiCp, while thermal conductivity was insensitive to the amount of inorganic binder. The experimental values of the coefficient of thermal expansion and thermal conductivity were in good agreement with the calculated coefficient of thermal expansion based on Turner's model and the calculated thermal conductivity based on Maxwell's model.

[62] REACTION OF MAGNESIUM BORIDE PARTICLES IN MECHANICALLY ALLOYED TI-4WT%MGB2

Wilson JA. Steeds JW. Wilkes DMJ. Goodwin PS. Ward-Close CM. - Journal of Materials Science. 36(1):67-75, 2001

A Ti-4wt%MgB2 alloy was produced by mechanical alloying (MA) Ti and MgB2 powders for 48 hours in a Spex 8000 mill. TEM analysis of the alloy showed it to consist of a nanocrystalline (10-20 nm) Ti matrix, which enclosed 20-300 nm MgB2 particles. Following heat treatments at 600 degreesC, plate like structures of a previously unknown compound were observed to have extended into the crystals. Convergent beam electron diffraction (CBED) confirmed the new phase to have the same basic arrangement of atom sites as in the NiAs structure. Parallel electron energy loss spectroscopy (PEELS) and energy dispersive X-ray analysis (EDX) measurements identified the elements Ti, Mg and B within these plates. However, the exact proportions of these elements and their distribution within the unit cell could not be determined.

[61] HIGH MAGNETIC PERFORMANCE NDFE10.5MO1.5NX PREPARED BY MECHANICAL ALLOYING

Zhang SG. Li DP. Ying QM. Zhou ML. Zuo TY. - Journal of Materials Science. 36(1):107-111, 2001

Spherical or nearly regular hexagonal Nd powders with the size of 20-150 nm, Fe powders with the size of 20-150 nm and Mo powders with the size of 80-100 nm were prepared by Argon and Hydrogen arc plasma. The nanostructural NdFe10.5Mo1.5 compound with ThMn12-type structure have been formed after having been mechanically alloyed for 6-12 hours and crystallized at 700-850 degreesC under high purified Argon atmosphere. After having been nitrided at 400-500 degreesC for 2 hours, NdFe10.5Mo1.5Nx nanopowders with ThMn12-type structure can be obtained, which have excellent permanent magnetic properties such as iH(c) within range of 360.4-716.2 kA/m (4528-8997 Oe), B-r within range of 0.6363-0.9831 T (6363-9831 Gs), (BH)(max) within range of 42.87-166.2 kJ/m(3) (5.386-20.88 MGOe

[60] FORMATION MECHANISM OF TITANIUM SILICIDE BY MECHANICAL ALLOYING

Byun CS. Bopark S. Kim DK. Lee W. Hyun CY. Reucroft PJ. - Journal of Materials Science. 36(2):363-369, 2001

The syntheses of five titanium silicides (Ti3Si, TiSi2, Ti5Si4, Ti5Si3, and TiSi) by mechanical alloying (MA) have been investigated. Rapid, self-propagating high temperature synthesis (SHS) reactions were involved in producing the last three materials during room temperature high-energy ball-milling of elemental powders. Such reactions appeared to occur through ignition by mechanical impact in the fine powder mixture formed after a critical milling period. From in-situ thermal analyses, each critical milling period for the formation of Ti5Si4, Ti5Si3, and TiSi was observed to be 22, 35.5 and 53.5 minutes, respectively. However, the formation of Ti3Si and TiSi2 did not occur even after 360 minutes of milling of as-received Ti and Si powder mixture, due to the lack of homogeneity of the powder mixture. Other ball-milling procedures were employed for the syntheses of Ti3Si and TiSi2 using different sizes of Si powder and milling medium materials. Ti3Si was synthesized by milling a Ti and 60 minutes premilled Si powder mixture for 240 minutes. alpha -TiSi2 and TiSi2 were produced by high energy partially stabilized zirconia (PSZ) ball-milling for 360 minutes in a steel vial followed by jar-milling of a Ti and 60 min premilled Si powder mixture for 48 hr. The formation of Ti3Si and TiSi2 occurs through a slow

solid state diffusion reaction, and the product(s) and reactants coexist for a certain period of time. The formation of titanium silicides by MA and the reaction rate appeared to depend on the homogeneity of the powder mixture, milling medium materials, and heat of formation of the product involved.

[59] THE EFFECT OF TIN INGREDIENTS ON ELECTROCATALYTIC ACTIVITY OF RANEY-NI PREPARED BY MECHANICAL ALLOYING

Tanaka S. Hirose N. Tanaki T. Ogata YH. - International Journal of Hydrogen Energy. 26(1):47-53, 2001

Sn was added to the conventional Raney-Ni precursor powder by the mechanical alloying in order to improve the catalytic activity for hydrogen evolution reaction (HER). After teaching Al, the cathodic performance of the modified powder was investigated in 1 M NaOH at 303 K. Sn was incorporated in the Raney-Ni precursor alloy after mechanical alloying. This was confirmed by differential thermal analysis (DTA) and energy-dispersive X-ray spectroscopy (EDX). However, the appearance of a new phase due to the mechanical alloying was not observed by X-ray diffraction analysis (XRD). The Sn-containing Raney-Ni cathode indicated a decrease of the hydrogen oven;voltage. This is because the Tafel slope of the Sn-containing Raney-Ni cathode decreases from 180 to 95 mV/decade. The Raney-Ni cathode prepared by electrochemical codeposition could increase the electrocatalytic activity when the mechanical alloyed powder substitutes for the conventional Raney-Ni precursor powder.

[58] ADDITIVES EFFECT ON THE FORMATION AND THERMAL STABILITY OF ALUMINUM TITANATE AT LOW TEMPERATURE [SPANISH]

De Arenas IB. Arenas F. Cho SA. Martinez S. Sicardi R. - Boletin de la Sociedad Espanola de Ceramica y Vidrio. 39(6):699-703, 2000

This work presents the study of the effect of 3 wt% V2O5, Na2O, CaO and FeTiO3 on the stabilization of Aluminum Titanate (Al2TiO5). Samples were prepared by the conventional processing route of dry ball milling followed by wet mixing and final uniaxial pressing at 300 MPa before sintering at 1400 degreesC. Specimens were heat treated at 1000 degreesC during 12 and 20 hours in order to evaluate Al2TiO3 decomposition. The microstructure was observed by Scanning Electron Microscopy (SEM) and phases present were determined by X Ray Diffraction (XRD) and Energy Dispersive Spectroscopy (EDS). It has been elucidated the effect of FeTiO3 (Ilmenite) on the improvement of the formation and thermal stabilization of Al2TiO5. **[57] HIGH-RESOLUTION ELECTRON MICROSCOPY OBSERVATIONS OF MICROPLASTIC FRACTURE IN SIC UNDER BALL MILLING AT ROOM TEMPERATURE**

Yang XY. Wu YK. Ye HQ. - Philosophical Magazine Letters. 81(1):1-8, 2001

Nanometre-sized kinks and cracks formed in 6H SiC under ball milling (BM) at room temperature have been observed and characterized on the atomic scale using high-resolution electron microscopy (HREM). Observations of the kinks show that numerous positive and negative partials are aligned at either of the kink boundaries, and the stacking sequences in the kink band are considerably different from those in the other areas. It was also observed that the (0001) lattice planes in the kink band are kinked, indicating that microplasticity occurs in the normally brittle material SiC under BM even at room temperature. HREM observations of cracks show that cracks previously observed by transmision electron microscopy are not completely open but are at the initiation stage of fracture. Inside a crack, one residual kink region can be clearly observed, which indicates a correlation between kink and crack, that is a crack evolves from a kink

[56] ON ICOSAHEDRAL PHASE FORMATION IN MECHANICALLY ALLOYED AL70CU20FE10

Srinivas V. Barua P. Murty BS. - Materials Science & Engineering A-Structural Materials Properties Microstructure & Processing. 294(Special Issue SI):65-67, 2000

The formation of icosahedral phase by mechanical alloying of crystalline elemental powders has been investigated. The effect of milling energy on icosahedral phase formation in Al70Cu20Fe10 has been studied using X-ray diffraction and energy dispersive X-ray (EDX) microanalysis. In order to study the alloying process during milling, different starting compositions of Al, Cu and Fe elemental blends have been used. The present study indicates that even though the intermediate phases formed during milling are the same, the icosahedral phase formation is sensitive to the way in which the nominal composition is reached

[55] QUASICRYSTALLINE AL-ALLOYS WITH HIGH STRENGTH AND GOOD DUCTILITY

Schurack F. Eckert J. Schultz L. - Materials Science & Engineering A-Structural Materials Properties Microstructure & Processing. 294(Special Issue SI):164-167, 2000

The formation of quasicrystalline phase in Al-Mn and Al-Mn-Ce/Fe alloys by solid state reaction via mechanical alloying of elemental powder mixtures and ball milling of prealloys was investigated. The samples were analysed by X-ray diffraction, transmission-and scanning-electron microscopy and differential-scanning calorimetry. The formation of a stable fci-phase in the Al-Mn-Pd system by mechanical alloying is described. A dual-phase microstructure of Al-matrix and quasicrystalline phase was created by an initial excess of aluminium or subsequent blending of quasicrystalline powder with purr aluminium. Bulk samples,were processed by squeeze casting revealing excellent mechanical properties

[54] COMPACTION AND SINTERING BEHAVIOUR OF GLASS-ALUMINA COMPOSITES

Ray A. Tiwari AN. - Materials Chemistry & Physics. 67(1-3 Special Issue SI):220-225, 2001

The effects of Al2O3 additions on the compaction and sintering behaviour of a leadborosilicate glass (LG) have been investigated. LG powder was prepared by melting, fritting and milling a glass of the composition: 77PbO, 10B(2)O(3), 10SiO(2), 2Al(2)O(3) and IP2O5 (wt.%). The mean particle sizes of the powders were: LG, 6.5 mum and Al2O3, 3.3 mum The compaction behaviour of LG-Al2O3 powder mixtures can be represented by a new compaction equation: [(D-g - D-0)/(1 - D-0)] = (P/P-f)(n), where D-g is the relative green density, D-0 the relative tap density and n and Pr are material constants. The exponent pi decreases from 0.192 to 0.065 as the Al2O3 content is increased from 0 to 100 vol.%. The Frenkel equation for isothermal shrinkage has been found to be valid. It is shown that in the glass matrix composites the minimum sintering temperature can be determined by measuring the dilatometric deformation temperature. The presence of Al2O3 in excess of 15 vol.% has been found to strongly retard the sintering kinetics. An addition of 45 vol.% Al2O3 increases the activation energy for sintering from 67 to 112 kcal mol(-1). The presence of Al2O3 particles also induced a partial crystallisation in LG matrix

[53] SINTERED POROUS CERMETS BASED ON TIB2 AND TIB2-TIC-MO2C

Singh M. Rai KN. Upadhyaya GS. - Materials Chemistry & Physics. 67(1-3 Special Issue SI):226-233, 2001

TiB2 powder, with different binders (Ni and Ni/Mn), after milling were cold compacted (300 MPa) and sintered in H-2 at 1300 and 1350 degreesC for 1 h. To improve the sintering behaviour, TiC/Mo2C alloy carbide was added and the milled charge along with the same binders (Ni and Ni/Mn) was cold compacted and sintered under similar conditions. Sintered density, porosity, transverse rupture strength (TRS), grain size and lattice parameter of binder and hard phases were measured. Better densification was observed with Ni/Mn binder as compared to Ni binder for either hard phase based systems. Maximum value of TRS was noted for TiB2-TiC-Mo2C-40 wt.% Ni/Mn cermet. Melt exudation was observed for either hard phase based systems with Ni binder

[52] ELEMENTAL BLENDED POWDERS SEMISOLID FORMING OF TI-AL BASED ALLOYS

Yasue K. Yu GL. Wen CE. Yamada Y. - Journal of Materials Science. 35(23):5927-5932, 2000

Ti-6Al and Ti-6Al-4V alloys fabricated by semisolid forming are investigated with microscopic observation, density measurements, X-ray diffraction and mechanical property tests. The effects of the forming pressure, the forming temperature, and the forming loading time on the density of the green compacts are discussed. The shaped green-compact that is prepared by semisolid forming method transforms into intermetallics during the further alloying heat treatment. Pore-free green compacts are obtained under almost all the selective forming conditions. However, pores often appear after alloying heat treatment. The forming loading time has a relatively strong influence on the density of the compact. Experiments have also been carried out on various alloying treatments and the effects of the alloying treatment conditions on the mechanical properties of the compacts. It has been demonstrated that Ti-6Al-4V alloy can be fabricated by semisolid forming and the optimum alloying treatment conditions are at 1473 K treating for 7.2 ks, which can result in the best ultimate tensile strength of 1050 MPa and the elongation of 10% in excess of that of the plastic matériels

[51] POLYMORPHIC TRANSFORMATION AND POWDER CHARACTERISTICS OF TIO2 DURING HIGH ENERGY MILLING

Ren RM. Yang ZG. Shaw LL. - Journal of Materials Science. 35(23):6015-6026, 2000

Many studies have indicated that the reactivity of reactants can be enhanced greatly by mechanical activation through high energy ball milling. To understand this enhanced reactivity, the polymorphic transformation and the evolution of the powder characteristics of TiO2 and graphite mixtures during high energy ball milling was investigated using various analytical instruments. It was found that polymorphic transformation of anatase to srilankite and rutile took place during milling. Furthermore, amorphization of crystalline phases and crystallization of the amorphous phase occurred at the same time during milling. High energy milling also led to ultrafine crystallites, large specific surface areas, and substantial amounts of defects in the powder particles. Effects of the graphite addition and the milling temperature on the polymorphic transformation and the evolution of the powder characteristics were also investigated. It was proposed that the polymorphic transformation of TiO2 during;milling could be explained in terms of the temperature-pressure phase diagram if the temperature rise and high pressure at the collision site were taken into consideration

[50] THERMAL ANALYSIS INVESTIGATION OF HYDRIDING PROPERTIES OF NANOCRYSTALLINE MG-NI- AND MG-FE-BASED ALLOYS PREPARED BY HIGH-ENERGY BALL MILLING

Berlouis LEA. Cabrera E. Hall-Barientos E. Hall PJ. Dodd SB. Morris S. Imam MA. - Journal of Materials Research. 16(1):45-57, 2001

The hydrogen loading characteristics of nanocrystalline Mg, Mg-Ni (Ni from 0.1 to 10 at.%), and Mg-Fe (Fe from 1 to 10 at.%) alloys in 3 MPa H-2 were examined using high pressure differential scanning calorimetry and thermogravimetric analysis. All samples showed rapid uptake of hydrogen. A decrease in the onset temperature for hydrogen absorption was observed with increasing Ni and Fe alloy content, but the thermal signatures obtained suggested that only Mg was involved in the hydriding reaction; i,e., no clear evidence was found for the intermetallic hydrides Mg2NiH4 and Mg2FeH6. Hydrogen loading capacity decreased with temperature cycling, and this was attributed to a sintering process in the alloy, leading to a reduction in the specific surface available for hydrogen absorption

[49] PHASE CONSTITUTION AND MAGNETIC PROPERTIES OF ND10FE76B4M10 AND ND10FE76B2M12 (M = FE, TI, V, CR, MN, CO AND AL) ALLOYS PREPARED BY MECHANICAL ALLOYING

Liu W. Zhang ZD. Liu JP. Sun XK. Sellmyer DJ. Zhao XG. - Journal of Magnetism & Magnetic Materials. 221(3):278-284,

Phase constitution and magnetic properties of Nd10Fe76B4M10 and Nd10Fe76B2M12 (M = Fe,Ti,V,Cr, Mn,Co and Al) alloys prepared by mechanical alloying and subsequent annealing have been systematically studied. It is found that the components of phases in the alloys critically depend on the additive transition metals M. In all the alloys, only the addition of Ti give significant enhancement to the permanent-magnetic properties. The increase of the Curie temperature in the Ti-doped alloys with an excessively low B content implies that part of the Ti atoms may occupy crystalline sites other than the Fe sites. In all the M additive alloys, with increasing content of the additive elements, the quantity of 1:7 phase increases and that of Nd2Fe14B-type phase decrescendos

[48] BLENDING ADDITIONS OF ALUMINIUM AND COBALT TO ND16FE76B8 MILLED POWDER TO PRODUCE SINTERED MAGNETS

Mottram RS. Williams AJ. Harris IR.- Journal of Magnetism & Magnetic Materials. 222(3):305-313, 2000

A blending process involving the mixing of powders of NdFeB and pure aluminium and pure cobalt has been developed. This process has been shown to be an effective and simple way of adding aluminium or cobalt and aluminium to the composition. This allows the composition and hence properties of the finished magnets to be adjusted subsequent to the casting and milling of the basic alloy. With additions of Al between 0 and 3 at%, a progressive decrease in the remanence was observed. However, the coercivity was improved with a maximum improvement of 28% for an addition of 2 at% Al. The improved coercivity was attributed to the more uniform distribution of the grain boundary phase. Combined additions of Al and Co again resulted in a reduction in remanence for increased Al additions. The combined addition of Al and Co reduced the loss in coercivity observed for additions of Co alone. EDX analysis of the grain boundaries showed the formation of Nd(Fe,Al), and Nd,(Co, Fe), as well as an improved distribution of the grain boundary phase

[47] SOLID STATE PHASE TRANSFORMATIONS IN LIALH4 DURING HIGH-ENERGY BALL-MILLING

Balema VP. Pecharsky VK. Dennis KW. - Journal of Alloys & Compounds. 313:69-74, 2000

Mechanochemical processing of polycrystalline LiAlH4 revealed good stability of this complex aluminohydride during high-energy ball-milling in a helium atmosphere for up to 35 h. The decomposition of lithium aluminohydride into Li3AlH6, Al and H-2 is observed during prolonged mechanochemical treatment for up to 110 h and is most likely associated with the catalytic effect of a vial material, iron, which is introduced into the hydride as a contaminant during mechanical treatment

[46] HIGH TEMPERATURE MECHANICAL PROPERTIES OF A SUBMICROCRYSTALLINE TI-47AL-3CR ALLOY PRODUCED BY MECHANICAL ALLOYING AND HOT ISOSTATIC PRESSING

Shagiev MR. Senkov ON. Salishchev GA. Froes FH. - Journal of Alloys & Compounds. 313:201-208, 2000

High temperature tensile properties of a TiAl-based alloy with a submicrocrystalline structure were studied in the temperature range of 800 to 1200 degreesC and the strain rate range of 10(-4) to 3x10(-1) s(-1). The alloy was produced by hot isostatic pressing of an amorphous mechanically alloyed powder and contained two phases, TiAl and Ti2AlN; the latter resulted from contamination of the powder with nitrogen during mechanical alloying. Two temperature ranges with different behavior were distinguished. In the temperature range of 800 to 950 degreesC, the stress exponent, n=6, and the activation energy of deformation, Q=497 kJ mol(-1), were typical to a climb controlled deformation mechanism. In the temperature range 1000 to 1200 degreesC, the stress exponent, n=3, and the activation energy, Q=347 kJ mol(-1), were determined together with high elongation indicating superplastic behavior

[45] DIRECT HYDROGENATION OF MG AND DECOMPOSITION BEHAVIOR OF THE HYDRIDE FORMED

Wang P. Zhang HF. Ding BZ. Hu ZQ. - Journal of Alloys & Compounds. 313:209-213, 2000

Under the catalytic action of ZrFe1.4Cr0.6, magnesium was hydrided into nanostructured MgH2 and gamma -MgH2 directly by reaction ball-milling. The formation and decomposition behaviors of the hydrided phases were characterized by X-ray diffraction and thermal analysis (TGA and DSC). The hydrided phases thus formed possess excellent dehydriding kinetics. Based on the calculation of local activation energy, the decomposition mechanism of the hydrided phases was probed

[44] EFFECT OF THERMAL TREATMENT ON THE ATOMIC ORDERING OF MECHANICALLY ALLOYED AL3NB

Lee KM. Lee JS. Lee DJ. Kim SS. Ahn IS. Park MW. - Journal of Alloys & Compounds. 313:214-217, 2000

The present study was carried out to investigate the effect of thermal treatment on the atomic ordering of mechanically alloyed Al3Nb. The partially disordered Al3Nb alloy is transformed into an ordered IO-nm sized Al3Nb after a following heat treatment. The value of DeltaH(order) for ordering of Al3Nb intermetallics is more negative for faster heating rates and prolonged milling time. The average values of DeltaH(order) correspond to about 35% of the DeltaH necessary for Al3Nb phase formation. The activation energies for ordering of Al3Nb at 30 and 40 h of milling an relatively close to the isothermal grain growth enthalpy of nanocrystalline Al3Nb intermetallics.

[43] HYDROGENATION CHARACTERISTICS OF MG-TIO2 (RUTILE) COMPOSITE

Wang P. Wang AM. Zhang HF. Ding BZ. Hu ZQ. - Journal of Alloys & Compounds. 313:218-223, 2000

The nanostructured composite Mg-TiO2 (rutile) was prepared by reaction ball milling (RBM). Under the combined effects of the catalyst n-TiO2 and the mechanical driving force, Mg was hydrided into MgH2 and gamma -MgH2 directly during RBM. The addition of TiO2 resulted in a markedly improved hydrogenation performance of Mg, rapid kinetics, low working temperature and excellent oxidation-resistance. A hydrogenation mechanism of the composite was proposed on the basis of microstructure analysis

[42] MECHANICALLY INDUCED GAS-SOLID REACTION FOR THE SYNTHESIS OF NANOCRYSTALLINE ZRN POWDERS AND THEIR SUBSEQUENT CONSOLIDATIONS

El-Eskandarany MS. Ashour AH. - Journal of Alloys & Compounds. 313:224-234, 2000

Equiatomic nanocrystalline ZrN powders with an average grain size of less than 8 nm in diameter have been fabricated by high energy ball-milling elemental powders of Zr under nitrogen gas-flow at room temperature. The ductile powders of Zr tend to agglomerate during the first stage of the reactive ball milling (RBM; <11 ks) to form powder particles with larger diameters. The powders are then intensively disintegrated into smaller particles during the second stage of milling (11-43 ks). These disintegrated particles that have fresh or new surfaces begin to react with the milling atmosphere (nitrogen) during this stage of milling to form a cubic phase of ZrN powder coexisting with unreacted hcp-Zr powder. Towards the end of milling (86-173 ks), a single phase of nanocrystalline ZrN (NaCl-structure) is obtained. The powders of this end-product have spherical like morphology with average particle size of about 0.4 <mu>m in diameter. Cold and hot pressing techniques were employed to consolidate the powders at the several stages of the RBM. The as-milled and as-consolidated powders were characterized as a function of the RBM time by means of X-ray diffraction, transmission electron microscopy, scanning electron microscopy, optical metallography and chemical analyses. The results have shown that the consolidated ZrN compact of the end product (173 lis of RBM) still maintains its unique nanocrystalline characteristics with an average grain size of less than 80 nm. Density measurements of these consolidated samples of the end-products (86-173 ks of the RBM) show that they are essentially fully dense (above 99% of the theoretical density for ZrN). The dependences of the hardness on the grain size and the consolidation temperatures were investigated.

[41] THE SURFACE STATE OF NANOCRYSTALLINE AND AMORPHOUS MG2NI ALLOYS PREPARED BY MECHANICAL ALLOYING

Lee HY. Goo NH. Jeong WT. Lee KS - Journal of Alloys & Compounds. 313:258-262, 2000

Amorphous (Mg1-xZrx)(2)Ni alloys with the composition of x=0.1 and 0.3 were synthesized by mechanical alloying (MA). A nanocrystalline Mg2Ni phase was also formed by MA without Zr addition. X-ray photoelectron spectroscopy (XPS) was used to investigate the atomic bindings of the alloying elements at the electrode surface. The analysis of the XPS of Mg Ip spectra showed that the atomic binding of Mg at the amorphous or nanocrystalline surface was lower than at the crystalline one. However, the Ni 2p spectra showed little variation in the amorphous or nanocrystalline phase compared to the crystalline. The looser binding of Mg at the surface indicates that the surface energy of the amorphous or nanocrystalline electrode was increased, and the hydrogen diffusion and charge transfer reaction enhanced. A passive layer of Mg(OH)(2) and rapid degradation of the electrode were also caused by the looser binding of Mg

[40] FORCED MIXING AND NANOSCALE DECOMPOSITION IN BALL-MILLED CU-AG CHARACTERIZED BY APFIM

F. Wu, P. Bellon, A. J. Melmed and T. A. Lusby - Acta Materialia, 49(3), Pages 453-461 (2001).

Ag50Cu50 alloys are prepared by high energy ball milling at different controlled temperatures, 85 K, 315 K and 453 K, with milling times long enough to reach steady-state. Atom probe field ion microscopy (APFIM) is used to characterize the atomic

mixing forced by low temperature milling and to study the nanocomposite materials stabilized by elevated temperature milling. A new méthode is devised that makes it possible to prepare sharp tips from ball-milled powders. Statistical analysis of the APFIM composition profiles is used to determine the degree of mixing as a function of the length scale. These results are compared with the ones obtained from kinetic Monte Carlo simulations. Cryo-milling results in nearly random mixing of copper and silver, whereas the mixing achieved by milling at 315 K is calculated to be around 70%. 453 K milling results in the decomposition into copper-rich and silver-rich regions at a scale of 25 nm.

[39] DIRECT PHASE TRANSFORMATION FROM HEMATITE TO MAGISTER DURING HIGH ENERGY BALL MILLING

N. Randrianantoandro, A.M. Mercier, M. Hervieu, J.M. Grenèche, , Materials Letters 47 (3) (2001) pp. 150-158.

Hematite -Fe2O3 powder was milled with a dispersing liquid (ethanol) for different times using a conventional planetary ball mill equipped with steel vial. Both high resolution transmission electron microscopy, X-ray diffraction and zero-field and in-field Mössbauer spectrometry measurements reveal that the nanostructured powders contain maghemite, suggesting that our milling conditions favour the direct transformation from -Fe2O3 into -Fe2O3. Both the origin and the kinetics of the transformation are discussed in terms of mechanical aspects.

[38] MECHANOCHEMICAL ACTIVATION OF INDUSTRIAL CATALYSTS: 2. ADSORPTION PROPERTIES OF ACTIVATED CATALYSTS

Tret'yakov VD. Burdeinaya TN. Vlasova YA. Meshcheryakov SV. Bianchi D. - Petroleum Chemistry. 40(6):378-382, 2000

The results of a NO, CO, and O-2 temperature-programmed desorption study of mechanochemically activated industrial NTK-10-1 and nickel-chromia catalysts and their binary composition MK1a(1) are reported. The effect of reduction/reoxidation processes on the surface of oxide catalytic systems on the absorption capability was investigated. A correlation between the surface properties of the catalysts and their catalytic activity in the reaction of selective NO reduction with propane was established. Two forms of adsorbed CO, the weakly and the strongly bound carbon monoxide desorbed from the surface as initial adsorbate molecules and CO2, respectively, were shown to be present at the NTK-10-1 surface. It was found that copper on the surface of the catalyst NTK-10-1 primarily occurs in the form of Cu(II) cations at which NO adsorption and reaction with propane takes place. The surface of the catalytic composition MK1a(1) adsorbs three times the amount of NO that might be contributed by its individual components, the NTK-10-1 and Ni-Cr oxide catalysts, thus showing the synergism or nonadditive enhancement of the adsorption capability of the binary composition

[37] PLASMA-ASSISTED SINTERING OF MULLITE-ZRO3 CERAMICS [SPANISH]

de la Torre SD. Miyamoto H. Ramirez HB. Rangel ER. - Revista Mexicana de Fisica. 46(6):519-522,

The reaction of a powder mixture of ZrSiO4+ Al + Al2O3 has been induced by a techniques combination; milling process, oxidation at 1100 degreesC and spark plasma sintering to produce dense mullite-ZrO2 ceramics. The spark plasma sintering process has showed be a powerful technique of production to sintered and to provoke fast reaction of a mixture in prereaction state of zircon and alumina. Letting to obtain bodies with high tetragonal zirconia contents. The tetragonal zirconia form let the improvement of densification and mechanical properties of mullite-ZrO2 ceramics

[36] MECHANOSYNTHESIS OF INTERMETALLIC FE100-XALX OBTAINED BY REDUCTION OF AL/FE2O3 COMPOSITE

Goya GF. Rechenberg HR. - Journal of Physics-Condensed Matter. 12(50):10579-10590,

AlxFe100-x alloy has been obtained through mechanical alloying of Al + Fe2O3 under an argon atmosphere. The resulting phase has a composition dose to Al30Fe70 with disordered body-centred cubic structure and cell parameter a = 2.892(4) Angstrom. The magnetic properties studied by Mossbauer and magnetization measurements are consistent with an x similar to 30 composition. Annealing at 983 K produces only minor changes in the magnetic properties. A possible mechanism for formation of AlxFe100-x is suggested, consisting of(a) initial grain downsizing to nanometric scale and (b) subsequent decomposition of alpha -Fe2O3 producing metallic iron that is dissolved into the Al matrix. In contrast, no new phases were produced in a twin experiment on ball-milled Fe + Al2O3, carried out under identical milling conditions

[35] SELF-PROPAGATING EXOTHERMIC REACTIONS BETWEEN SILICON AND TRANSITION METALS OF GROUPS IVA-VIA INDUCED BY MECHANICAL ALLOYING

Yen BK. - Journal of Applied Physics. 89(2):1477-1483,

Chemical reactions between Si and transition metals of groups IVA-VIA induced by mechanical alloying have been investigated. Depending on the exothermicity, reactions could proceed via the solid-state diffusion mechanism or the mechanically induced self-propagating reaction (MSR) mechanism, which is analogous to that of the combustion synthesis. For reactant systems with high adiabatic temperatures (T-ad), such as silicides of Zr and Nb, Ti5Si3, TiSi, and MoSi2, spontaneous reactions proceeded via the MSR mechanism. There existed a threshold T-ad of 1850 K, below which silicon-metal systems reacted via the gradual solid-state diffusion mechanism during mechanical alloying. Since morphological observations of the MSR product indicated the occurrence of self-propagating reactions in the presence of a liquid phase, the effect of reactant melting temperatures on the threshold T-ad was elucidated with additional experiments involving carbon-metal reactant systems

[34] IN-SITU TIME-RESOLVED X-RAY DIFFRACTION EXPERIMENTS APPLIED TO SELF-SUSTAINED REACTIONS FROM MECHANICALLY ACTIVATED MIXTURES

Bernard F. Charlot F. Gras C. Gauthier V. Gaffet E. - Journal de Physique IV. 10(P10):89-99,

Mechanically activated self-propagating high-temperature synthesis (MASHS) provides an attractive practical method for producing advanced materials such as ceramics, composites and intermetallics. This kind of reaction has been investigated in-situ using the Time resolved X-Ray Diffraction (TRXRD), with an X-ray synchrotron beam (D43 beam line, LURE Orsay) coupled to simultaneous infrared thermography to study structural transformations and thermal evolution. With short

acquisition times (from 30ms to 100ms per pattern)), it has been possible to observe several steps before obtaining compounds. Two different compound formations have been described (i) Owing to the temporal resolution of 100 ms between two consecutive diffractograms, it was possible to observe several steps before obtaining the niobium aluminide compound NbAl3. Indeed, the phase transformations corresponding to the aluminum melting plateau, the subsequent temperature increase to the ignition temperature and the fast reaction between niobium and molten aluminum at such a temperature were well-identified. (ii) Despite a temporal resolution of 33ms between 2 consecutive diffractograms, no intermediate phase was observed during the combustion front passage. The only reaction responsible for the self-sustaining reaction is Mo + 2Si --> MoSi2 in the primary zone inside the combustion wave.

[33] THERMODYNAMIC MODELING OF MECHANICAL ALLOYING IN THE FE-SN SYSTEM

Dorofeev GA. Elsukov EP. - Inorganic Materials. 36(12):1228-1234, 2000

X-ray diffraction analysis and thermodynamic calculations in the Miedema model are used to study the sequence of solid-state reactions during mechanical alloying in the Fe-Sn system, The results indicate that the formation of FeSn2 in the initial stages of the process is a quasi-equilibrium process reducing the volume contribution to the free energy. A simple model, considering a random distribution of particles, is used to obtain an expression for the total free energy, comprising the volume and interface contributions, as a function of particle size. It is shown that the formation of a supersaturated solid solution is thermodynamically possible over a wide composition range if the particle size is reduced to a few nanometers and surface Sn segregation occurs. The limit of the supersaturated solid solution obtained by mechanical alloying is determined by the relationship between the limit of size reduction and the particle size which ensures stabilization of the solid solution. In the Fe-Sn system, the limit of the supersaturated fee solid solution is found to be 20 at. % Sn

[32] MICROSTRUCTURAL AND PHASE TRANSFORMATIONS DURING THE PREPARATION OF NI-GE SOLID SOLUTIONS BY MECHANICAL ALLOYING

Grigor'eva TF. Korchagin MA. Barinova AP. Ivanov EY. Boldyrev VV. - Inorganic Materials. 36(12):1235-1238,

Data are presented on the mechanically activated formation of solid solutions in the Ni-Ge system, where the constituent metals differ sharply in mechanical properties. X-ray diffraction and electron microscopy examination reveals successive formation of layered composites, intermetallic compounds, and fine-particle solid solutions with a highly disordered structure

[31] MECHANO-CATALYTIC OVERALL WATER SPLITTING ON SOME MIXED OXIDES

Hitoki G. Takata T. Ikeda S. Hara M. Kondo JN. Kakihana M. Domen K. - Catalysis Today. 63(2-4):175-181, 2000

Simple transition metal oxides such as NiO, Co3O4, Fe3O4 and Cu2O were found to catalytically decompose water into H-2 and O-2 by mechanical energy, The reaction is regarded as "mechano-catalytic" overall water splitting" and is a quite novel catalytic reaction. In this paper, some,general aspects on the mechano-catalytic overall water splitting are reviewed on simple oxides. In addition, recent results on the mechano-catalytic activity of a groups of mixed oxides, wolramite-type oxides with a formula of ABO(4) (A = Fe, Co, Ni and Cu, etc., B = W, Mo), are shown. AWO(4) (A = Fe, Co, Ni and Cu) decomposed water into H-2 and O-2 under the supply of mechanical energy, indicating that mechano-catalytic overall water splitting proceeded on wolframite-type compounds containing 3d-transition metals. AMoO(4) (A = Fe, Co, Ni) also decomposed water into H-2 and O-2 under supply of mechanical energy. The reaction properties on wolframite-type oxides are discussed

[30] MECHANO CHEMICAL SYNTHESIS OF A SILVER ION CONDUCTOR IN THE SYSTEM AGI-AG3PO4

Machida N. Nishida S. Shigematsu T. Sakai H. Tatsumisago M. Minami T. - Solid State Ionics. 136(Special Issue SI):381-386,

A high-energy ball-milling process was applied to the preparation of silver ion conductors from the compositions 80AgI . 20Ag(3)PO(4) and 60AgI . 40Ag(3)PO(4) (mol%) the composition 80AgI . 20Ag(3)PO(4) corresponds to that of the crystalline Ag7I4PO4 superionic phase, and the composition 60AgI . 40Ag(3)PO(4) is reported as a typical composition of the superionic conducting glasses in this system. For the composition 80AgI . 20Ag(3)PO(4), ball milling for longer than 190 h led to the formation of an unknown new crystalline phase, and the new phase showed a high ion conductivity of 6 x 10(-2) S cm(-1) at room temperature. The conductivity is higher than that of the crystalline Ag7I4PO4 phase. The ball-milling process for the composition 60AgI . 40Ag(3)PO(4) made it amorphous, and the ball-milled sample showed a high ion conductivity very similar to that of melt quenched glass with the same chemical composition

[29] PREPARATION OF AMORPHOUS SOLID ELECTROLYTES IN THE SYSTEM LI2S-SIS2-LI4SIO4 BY MECHANICAL MILLING

Tatsumisago M. Morimoto H. Yamashita H. Minami T. - Solid State Ionics. 136(Special Issue SI):483-488,

Amorphous solid electrolytes in the system Li2S-SiS2-Li4SiO4 were successfully prepared from a mixture of Li2S, SiS2 and Li4SiO4 crystals using a mechanical milling technique at room temperature. In the composition range 0 less than or equal to x less than or equal to 5 of (100-x)(0.6Li(2)S.0.4SiS(2)).xLi(4)SiO(4). conductivities of the oxysulfide powders mechanically milled for 20 h were as high as 10(-4) S cm(-1) at room temperature, which are comparable to the values of the corresponding composition of melt-quenched glasses. As the period of mechanical milling treatment was increased from 0 to 20 h, the structure of milled powders became similar to that of the glasses prepared by melt quenching. Such a structure change brought about a large conductivity increase in the resultant powders from 10(-9) to 10(-4) S cm(-1

[28] CATALYSIS OF RUTHENIUM-METAL OXIDES MECHANICALLY MIXED WITH SULFATED ZIRCONIA FOR REACTION OF BUTANE TO ISOBUTANE

Hino M. Arata K. - Reaction Kinetics & Catalysis Letters. 71(1):71-76,

A highly active catalyst for the skeletal isomerization of butane to isobutane was obtained by mechanically mixing S0(4)/ZrO2 and Ru/SnO2; Ru/SnO2 was prepared by impregnating tin hydroxide with a solution of RuCl3 followed by calcining at 450 degreesC (0.5 wt.% Ru). The catalyst was much more active than Ru-SO4/ZrO2 prepared by co-impregnation of zirconia with the Ru and sulfate materials the temperature difference to show the same conversion between both catalysts being 57 degreesC. The effect of mixing of Ru was observed with other metal oxides as supports, Fe2O3, Al2O3, ZrO2, TiO2, and SiO2; the calcination temperature of the Ru-impregnated hydroxides was 250, 300, and 400 degreesC for the latter three, respectively

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[27] MICROSTRUCTURES IN TI-AL INTERMETALLIC COMPOUNDS IRRADIATED AT 673 K IN HFIR
Miwa Y. Sawai T. Fukai K. Hoelzer DT. Hishinuma A. - Journal of Nuclear Materials. 283(Part A):273-277,
Four kinds of Ti-Al intermetallic compounds were made from powder metallurgical processing using mechanical alloying or plasma rotating electrode processing. One consisted of alpha (2)-Ti3Al single phase, and the others consisted of alpha (2)-Ti3Al and gamma -TiAl duplex phases. These intermetallic compounds were irradiated at 673 K to the fluence of 5.16x10(25) n/m(2) (E>1 MeV) in the high flux isotope reactor. After irradiation, transmission electron microscopy was carried out. Cavities were observed in both the alpha (2)-Ti3Al- and gamma -TiAl-phases. The nucleation behavior of cavities in the alpha (2)-Ti3Al- and gamma -TiAl-phases was influenced by chemical composition and fabrication protestes

[26] MICROSTRUCTURE CONTROL TO IMPROVE MECHANICAL PROPERTIES OF VANADIUM ALLOYS FOR FUSION APPLICATIONS
Kuwabara T. Kurishita H. Hasegawa M. - Journal of Nuclear Materials. 283(Part A):611-615, 2000
Powder metallurgy (PIM) methods including mechanical alloying (MA) treatment may be useful to improve both radiation resistance and high-temperature strength that are major concerns in the use of V-4Cr-4Ti for fusion reactor structural applications. For the PIM methods, however, there is a critical issue that solute oxygen and nitrogen contained in the starting powders and introduced through the fabrication processes cause a serious loss of ductility. In this paper, a process for microstructure control to solve the issue is proposed and applied to fabricate a vanadium alloy. The microstructures and mechanical properties of the fabricated ahoy are also presented. It is shown that the proposed process is very effective in removing solute oxygen and nitrogen from the matrix resulting in a significant suppression of the ductility loss and that optimizing MA conditions will bring about further improvement in the ductility at low temperatures.

[25] DEVELOPMENT OF AN OXIDE DISPERSION STRENGTHENED, REDUCED-ACTIVATION STEEL FOR FUSION ENERGY
Romanoski GR. Snead LL. Klueh RL. Hoelzer DT. - Journal of Nuclear Materials. 283(Part A):642-646, 2000
A reduced-activation steel having a nominal chemical composition of Fe, 9% Cr, 2% W, 0.25% V, 0.1% Ta, and 0.1% C was mechanically alloyed with a fine dispersion of Y2O3 and TiO2 to assess the potential for extending the elevated temperature limit of this ahoy for structural applications. The total oxide dispersion content was varied from 0.25% to 1% and the molar ratio, TiO2/Y2O3 from 0 to 2. An argon atomized 9Cr2WVTa steel powder was ball milled under vacuum, extruded at 1150 degreesC to a 16 to 1 reduction in area, followed by a normalize and age heat treatment. Mechanical properties were assessed by elevated temperature tensile tests over the temperature range from room temperature to 800 degreesC. Transmission electron microscopy revealed a favorable dispersion of the oxide particles. Oxide dispersion strengthening by mechanical alloying resulted in significant improvement in elevated temperature tensile strengths. Extended ball-milling times improved oxide dispersion, microstructural refinement, and mechanical properties

[24] EFFECT OF MECHANICAL ALLOYING PARAMETERS ON IRRADIATION DAMAGE IN OXIDE DISPERSION STRENGTHENED FERRITIC STEELS
Yamashita S. Watanabe S. Ohnuki S. Takahashi H. Akasaka N. Ukai S. - Journal of Nuclear Materials. 283(Part A):647-651,
Issues for developing oxide dispersion strengthened (ODS) steel are anisotropic mechanical properties due to the bamboo-like structure, impurity pick up during the mechanical alloying (MA) process, stability of oxide particles, heat-treatment condition and chemical composition. Several ODS steels were fabricated with a changing gas environment during MA, heat-treatment condition and chemical composition, and were electron-irradiated to 12 dpa at 673-748 K in a high-voltage electron microscope. An ODS martensitic steel (M-Ar) with high dislocation density showed very good swelling resistance. Swelling levels of ODS ferritic steels depended on the gas environment during MA and the recrystallization condition. These indicated that a helium gas environment during MA was more effective to suppress swelling than an argon gas environment and that cold working after recrystallization reduced void formation and swelling. The effect of MA parameters, such as the gas environment, heat-treat condition and cold working on the swelling behavior was evaluated.

[23] LARGE-SCALE SYNTHESIS OF ULTRAFINE SI NANOPARTICLES BY BALL MILLING
Lam C. Zhang YF. Tang YH. Lee CS. Bello I. Lee ST. - Journal of Crystal Growth. 220(4):466-470, 2000
Si nanoparticles have been synthesized by ball-milling of graphite and SiO2 powders. The solid-phase reaction, C(graphite) + SiO2 --> Si + CO2, was found to be a novel technique for fabrication of ultrafine Si particles. The reduced Si in the powder assembled as nanoparticles with a wide range of diameters. Multiple-peak structures were observed in the photoluminescence spectra of the Si nanoparticles at room temperature. The peak energies were found to coincide with the PL peak pinning energies previously reported in porous Si. Thus, the fine structures of luminescence spectra could be attributed to the size quantization of the Si nanoparticles formed via solid-phase reaction during ball-milling

[22] HYDROGEN DISPROPORTIONATION BY REACTIVE MILLING AND RECOMBINATION OF ND-2(FE1-XCOX)(14)B ALLOYS
Bollero A. Gutfleisch O. Kubis M. Muller KH. Schultz L. - Acta Materialia. 48(20):4929-4934, 2000
Stoichiometric Nd-2(Fe1-xCox)(14)B alloys (x = 0, 0.25, 0.5, 0.75 and I)have been disproportionated into NdH2+delta and bcc-(Fe,Co) (0 less than or equal tox less than or equal to0.75) or fee-Co (x = 1), respectively, by milling in hydrogen at enhanced temperatures. Reactive milling leads to the disproportionation of the thermodynamically very stable Nd2Co14B alloy. This reaction is not possible via the conventional hydrogenation disproportionation desorption and recombination (HDDR) process. Grain sizes of disproportionated and recombined Nd-2(Fe,Co)(14)B materials were found to be <10 nm and 40-50 nm, respectively - approximately an order of magnitude smaller than those of conventional-HDDR processed alloys. The recombined Nd2Co14B alloy shows on average slightly smaller grain sizes than the Nd2Fe14B compound. A more effective exchange coupling leading to enhanced remanences, possibly due to the slightly smaller grain size, has been observed for Nd2Co14B powders recombined at 600-700<degrees>C

[21] DECOMPOSITION AND SINTERING OF ATTRITION-MILLED ANDULUSITE
H BalmoriRamirez, E TorresTorres, RC Bradt - IN REFRACTORIES FOR THE METALLURGICAL INDUSTRIES III, 1999, pp 233-247 - INTERNATIONAL SYMPOSIUM ON ADVANCES IN REFACTORIES FOR THE

METALLURGICAL INDUSTRIES III HELD AT THE 38TH ANNUAL CONFERENCE OF METALLURGISTS OF CIM; QUEBEC, CANADA. AUGUST 22-26, 1999

The influence of attrition milling on the decomposition and sintering of andalusite was studied. Commercial grade andalusite was attrition-milled for time intervals to 24 hours and then sintered at temperatures between 1000 degreesC and 1500 degreesC for 1 hour in air. Changes induced by the attrition milling were monitored by DTA, X-ray diffraction and surface area measurements. Sintering effects were followed by dilatometry, density measurements, phase analysis and microstructure observations. It was observed that mullite formation began at lower temperatures and densification proceeded to near theoretical with attrition milling.

[20] SYNTHESIS AND CHARACTERIZATION OF A LOW DENSITY TI-MG-SI ALLOY

M Cavusoglu, ON Senkov, FH Froes - DEVELOPMENT IN LIGHT METALS (Series: KEY ENGINEERING MATERIALS), 2000, Vol 188, pp 1-13 - INTERNATIONAL CONFERENCE ON DEVELOPMENT IN LIGHT METALS; CIOCCO, ITALY. SEPTEMBER 19-24, 1999

A low-density titanium alloy was synthesized by mechanical alloying (MA) of blended powders of titanium hydride (TiH1.924), magnesium and silicon, followed by reactive sintering. Differential thermal analysis (DTA) and x-ray diffraction (XRD) methods were utilized to study the phase transformations and phases produced. Scanning electron microscope (SEM) and transmission electron microscope (TEM) were used to study the powder morphology and microstructure. During heating the blended powders, decomposition of titanium hydride occurred and some silicon went in solid solution in titanium while the majority of the silicon reacted exothermically with magnesium at about 500 degreesC producing an intermetallic phase Mg2Si, which was stable up to 950 degreesC. Above 950 degreesC, Mg2Si melted forming a liquid solution of magnesium in silicon. The liquid silicon reacted with titanium forming Ti5Si3 phase, and Mg reacted with oxygen forming MgO. After annealing at 1100 degreesC, three stable phases, Ti(Si), Ti5Si3, and MgO, were present. During MA, all magnesium and silicon dissolved in the titanium hydride and an average grain size of similar to 5 nm was produced. The solid solution was stable on heating to a temperature of 400 degreesC, above which it decomposed with formation of Mg2Si (at similar to 450 degreesC) and Ti5Si3 (at similar to 570 degreesC). The Mg2Si decomposed completely at a temperature of 650 degreesC with the formation of MgO and Ti5Si3. After heating to 1100 degreesC, three stable phases, TiN0.3, Ti5Si3, and MgO were present in the MA material.

[19] ALUMINUM-LOW MELTING METAL ALLOYS PREPARED BY MECHANICAL ALLOYING WITH ADDITION OF OXIDE

J Kaneko, M Sugamata, L Blaz, R Kamei - DEVELOPMENT IN LIGHT METALS (Series: KEY ENGINEERING MATERIALS), 2000, Vol 188, pp 73-81 - INTERNATIONAL CONFERENCE ON DEVELOPMENT IN LIGHT METALS; CIOCCO, ITALY. SEPTEMBER 19-24, 1999

For the purpose of obtaining fine and uniform dispersion of low melting metals in the matrix of aluminum, pure aluminum powder was mechanically alloyed with addition of the oxide powders of low melting metals. Decomposition of the added oxides by displacement reaction of oxygen was studied during and after mechanical alloying. Fine dispersion of added oxides was attained in the matrix of aluminum by mechanical alloying with addition of methanol as the process control. Agent. X-ray diffraction revealed that decomposition of added PbO and Sb2O3 occurred during ball milling, whereas that of SnO2, Bi2O3, and In2O3 mas observed after hot pressing of the mechanically alloyed powders. By decomposition of the oxides, particles of low melting metals were dispersed in the matrix of aluminum except for Sb which forms an intermetallic compound SbAl with Al. Distribution of Sn and Pb in the hot-pressed and extruded P/M materials was shown to be extremely fine and uniform by EPMA and TEM-EDS analyses. It has been postulated that Al-based materials of higher tribological performance can be obtained by mechanical alloying with addition of oxides of low melting metals.

[18] MICROSTRUCTURAL REQUIREMENTS FOR ALUMINA SIC NANOCOMPOSITES

AJ Winn, RI Todd - ENGINEERING WITH CERAMICS (Series: BRITISH CERAMICS PROCEEDINGS), 1999, Iss 59, pp 153-164 - ANNUAL CERAMIC CONVENTION SYMPOSIUM ON ENGINEERING WITH CERAMICS; CIRENCESTER, ENGLAND. APRIL 21-22, 1998

The relative ease with which alumina/SiC nanocomposites polish, compared with monolithic alumina, has been noted in the literature and taken to be an example of the beneficial 'nanocomposite effect' stemming from an apparent strengthening of the grain boundaries. The percentage of 'polished' surface, as opposed to areas dominated by grain pullout or fracture, following grinding or polishing therefore provides an easily obtainable figure of merit for different nanocomposite materials. A variety of alumina/SiC nanocomposites have been fabricated by co-milling commercially available powders and hot pressing in an inert atmosphere. Using variations in starting powder size and heating schedules, it has been possible to produce nanocomposites with similar matrix grain size but with different proportions of particles on the grain boundaries relative to those within the grains. The microstructures were examined using TEM and FEG-SEM, and the effect of microstructural variations on the mechanical properties of the materials was investigated. Fracture surfaces were examined, and a study was made of the relative amounts of polished surface and grain pullout after both grinding and polishing the materials using standard metallographic techniques. The performance of the nanocomposites was compared with that of a pure alumina of the same grain size. The results indicate that the SiC has a direct effect on crack initiation and propagation in alumina, and that it is the particles on the grain boundaries which are responsible for the beneficial effect of the SiC additions. If sufficient SiC is present on the grain boundaries, crack initiation during abrasive wear can be prevented, resulting in a smoother, plastically deformed surface.

[17] NEW PARTICLES TECHNOLOGY FOR OXIDE-SUPERCONDUCTOR USING DRY- AND WET-TYPE JET MILL

H Kezuka, I Kato, T Shirane, M Ikeda - PROCEEDINGS OF THE 6TH INTERNATIONAL CONFERENCE ON PROPERTIES AND APPLICATIONS OF DIELECTRIC MATERIALS, VOLS 1 & 2, 2000, pp 794-796 - 6TH INTERNATIONAL CONFERENCE ON PROPERTIES AND APPLICATIONS OF DIELECTRIC MATERIALS; XIAN, PEOPLES R CHINA. JUNE 21-26, 2000

Superconducting YBCO particles with an average size of 1-2 mum were prepared by dry-type jet mill. It is found from the measurements of critical currents(Ic) that the superconducting transition temperature(Tc)at 91-92K is obtained for the YBCO particles which have oriented and elongated grains align parallel to(003) (005)and(006)-plane. On the other hand, fine YBCO particles were prepared from high quality superconducing YBCO powders by wet type jet mill in a high pressure flow of MEK (methyl-ethyl-ketone:CH3COCH2CH3)or toluene(C6H5CH3). As a result, the resulting particles are homogenius in MEK and fine YBCO particles show oriented and polycrystal structures with an average particle size of 164nm in diameter nd with the lattice parameter of a=3.9A, b=3.5A in [001]-orientation from TEM (Transmission Electron Microscopy) - studies.

[16] MECHANOCHEMICAL SYNTHESIS OF A COORDINATION POLYMER CONTAINING PARAMAGNETIC CHROMIUM COMPLEXES

Aleksandrov AI. Zelenetskii AN. Aleksandrov IA. Dubinskii AA. Garkusha OG. Prokof'ev AI. Bubnov NN. - Doklady Physical Chemistry. 375(1-3):215-217,

[15] MECHANOCHEMICAL SYNTHESIS OF LIMN2O4 CATHODE MATERIAL FOR LITHIUM BATTERIES

osova NV. Uvarov NF. Devyatkina ET. Avvakumov EG. - Solid State Ionics. 135(1-4 Special Issue SI):107-114,

The mechanochemical method was used for the synthesis of highly dispersed stoichiometric and nonstoichiometric LixMn2O4 spinel starting from different manganese (MnO2, Mn2O3, MnO) and lithium (LiOH, LiOH . H2O, Li2CO3) compounds. It is shown that the oxidation state of manganese greatly influences on the kinetics of mechanochemical reactions. On the other hand, different crystal structure and mechanical properties of initial lithium compounds result in different mechanisms of mechanochemical action on the activated mixtures. A strong effect of temperature and lithium content on the composition and lattice constant of the final products was found. Conductivity of LixMn2O4 spinels, measured by complex impedance spectroscopy, is likely caused by intergrain resistance. The activation energy of conductivity does not depend on x, the phase transition at 290+/-10 K, observed for stoichiometric spinel, is accompanied by a conductivity decrease. Test experiments in the electrochemical cell Li/LiPF6, EC/LiMn2O4,C demonstrate that lithium-manganese oxide obtained by the mechanochemical method is a promising cathode material for 4 V lithium batteries

[14] FORMATION OF AL-TIN METAL MATRIX COMPOSITE VIA MECHANOCHEMICAL ROUTE

Zhang F. Kaczmarek WA. Lu L. Lai MO. - Scripta Materialia. 43(12):1097-1102,

[13] FORMATION OF AL-TIN METAL MATRIX COMPOSITE VIA MECHANOCHEMICAL ROUTE

Zhang F. Kaczmarek WA. Lu L. Lai MO. - Scripta Materialia. 43(12):1097-1102,

[12] STELLITE BEARINGS FOR LIQUID ZN-/AL-SYSTEM WITH ADVANCED CHEMICAL AND PHYSICAL PROPERTIES BY MA

Zoz H. Benz HU. Huttebraucker K. Furken L. Ren H. Reichardt R. - Metall. 54(11):650-659, 2000

World-wide steel-industry is using hot-dip galvanizing/aluminizing for continuously (coil-) coating thin metal-sheets with zinc, zinc-aluminum and aluminum based materials for automotive, building and construction Industry as well as household appliances. The transfer systems and their bearings operating in the liquid metal belong to the most critical units of a coil-coating plant. The today's state of the art is still the application of slide bearings based on Stellite against Stellite which is in general a 50-60 wt% Co-matrix with incorporated Cr- and W-carbides and other composites, Mechanical Alloying (MA) is used to produce advanced Stellite-based bearing materials. A lubricating phase is introduced into Stellite-powder-material by MA, the composite-powder-particles are coated by High Energy Milling (HEM) In order to produce bearing-bushes of approximately 12 kg by Sintering, Liquid Phase Sintering (LPS) and Hot Isostatic Pressing (HIP). The chemical and physical behavior of samples as well as the bearing systems in the hot galvanizing / aluminizing plant are discussed. The materials are characterized by particle size analysis (laser diffraction), scanning electron microscopy and Xray diffraction, corrosive-wear behavior is determined using a special cylinder-in-bush apparatus (CIBA) as well as field-test ill real production condition. Part I of this work describes the initial resting phase where different sample materials are produced, characterized, consolidated and tested in the CIBA under a common Al-Zn-system. The results are discussed and the material-system for the large components to be produced for the field test in real production condition is decided

[11] MODELLING COMMINUTION DEVICES USING DEM

Cleary P. - International Journal for Numerical & Analytical Methods in Geomechanics. 25(1):83-105, 2001

Particle size reduction, or milling, is an essential component of mineral processing and is important in other industry sectors. This needs to be done as efficiently as possible, maximizing mill throughput while minimizing operating costs. Such milling processes typically use only 1-5 per cent of the supplied energy for particle breakage, which leaves room for improvement. In discrete element modelling (DEM) of granular hows the trajectories, orientations and spins of all the particles and objects in the system are calculated and their interactions with other particles and with their environment are predicted. It is necessary to simulate particles of many different sizes and densities interacting with complex-shaped objects moving in different ways. Particle flows in three types of mills; a 5 m ball mill, a 10 mm SAG mill and a 15 cm diameter centrifugal mill are predicted. Charge behaviour, torque and power draw are analysed for a range of rotation rates from 50 to 130 per cent of the critical speed for the ball mill. Sensitivity of the results to material properties and size distribution are examined. Radial size segregation is shown to occur and increases strongly with min speed. Charge motion and power consumption for the SAG

mill are predicted. Comparison of simulated flow patterns for the centrifugal mill with high-speed experimental photographs reveals dose agreement. The limitations and restrictions of this type of DEM model are discussed in detail

[10] SWITCHING PERFORMANCE OF W-AG ELECTRICAL CONTACTS FABRICATED BY MECHANICAL ALLOYING

Aslanoglu Z. Karakas Y. Ovecoglu ML. - International Journal of Powder Metallurgy. 36(8):35-43,

Blended elemental W - 35 w/o Ag powders were mechanically alloyed in a heavy duty attritor mill for times up to 15h followed by compaction, sintering, furnace cooling and re-sintering under industrial conditions. Changes in the morphology and microstructure of the as-milled powders and the compacts were characterized by scanning electron microscopy which revealed regions of nominal composition and loose W particles in the as-milled state. X-ray diffraction scans of the milled powders and compacts showed the presence of W and Ag peaks. Higher densities and hardness values were achieved for compacts mechanically alloyed at longer times. The arc erosion characteristics of the W-35w/oAg compacts confirmed that the erosion rate of contact material decreased with increasing milling time. an the basis of a linear regression estimate, all the compacts were found to be so for electrical contact applications. In particular, compacts mechanically alloyed for 10h were estimated to endure more than 3 x 10(6) opérations

[9] DISPERSION HARDENED CU-AL2O3 PRODUCED BY HIGH ENERGY MILLING

Rajkovic VM. Mitkov MV. - International Journal of Powder Metallurgy. 36(8):45-49,

Prealloyed copper powders containing different amounts of aluminum (Cu-1w/oAl, Cu-2.5w/oAl and Cu-3.5w/oAl) were processed in a planetary ball mill to evaluate matrix hardening due to the formation of the formation of Al2O3 particles in situ by internal oxidation, Following milling, the powders, were treated in hydrogen at 400 degreesC for 1h to eliminate oxide formed on the powder surfaces during milling. Compacts were obtained hot pressing in argon at 800 degreesC for 3h under a pressure of 35MPa. The copper matrix hardening was estimated by means of microhardness measurements. The prealloyed Cu-3.5w/oAl powder showed the most pronounced hardening. After 5h of milling the microhardness of the prealloyed compacts is 3 to 4 times higher than that of electrolytic copper compact under identical conditions

[8] MECHANOCHEMICAL SYNTHESIS OF CRB2-MOB2 COMPOSITE POWDER [JAPANESE]

Sasaki T. Iizumi K. Kudaka K. Okada S. - Nippon Kagaku Kaishi. (11):821-824,

Ball-milling of elemental powder mixtures without external heat application has been utilized as a process for the mechanochemical synthesis of high melting compounds. The mixtures of chromium, molybdenum and amorphous boron elemental powders with atomic ratios Cr : Mo : B = (1-x) : x: 2 (x =0-1.0) were comminuted for 10-40 h in a planetary ball-mill, and a single hexagonal phase (Cr1-x MoxB2) was formed after 40 h of milling using tungsten carbide balls. By annealing at 900-1400 degreesC, a single hexagonal phase was still observed at the compositions of x = 0-0.6. Al x = 0.8 and 1.0, the hexagonal phase was observed to be partly transformed to rhombohedral phase by annealing at the temperatures above 1300 and 1000 degreesC, respectively. The variation in the lattice parameters of the hexagonal phase with x was lion. The rhombohedral phase was estimated to be Mo2B5-x type by the determination of lattice parameters

[7] EFFECT OF NITRATE SALTS AS SINTERING ADDITIVES DURING THE BALL-MILLING PROCESS OF SILICON NITRIDE POWDERS

Urabe K. Yano T. Iseki T. - Journal of the American Ceramic Society. 83(12):2967-2973,

A chemical adsorption method in a Si3N4 slurry that contained a nitrate solution was studied during ball milling, with particular interest in increasing the oxide layer in the Si3N4 powder and improving the distribution homogeneity of the sintering additives. The nitrate salts Al(NO3)(3). 9H(2)O and Y(NO3)(3) . 6H(2)O mere selected as sintering additives. The following characterization techniques were used: oxygen-nitrogen analysis, X-ray photoelectron spectroscopy, high-resolution electron microscopy (coupled with energy-dispersive X-ray spectroscopy), and X-ray imaging (using wavelength-dispersive X-ray spectroscopy). The thickness of the amorphous layer and the oxygen content of the Si3N4 powder were greater for samples that were milled with nitrate additives, which,were heat-treated at 600 degreesC, than those of powders that were milled with oxide additives. The chemical composition of the oxygen-containing layer-that is, the amorphous layer that formed and/or changed on the SI3N4 surface-was similar to Si2N2O in heat-treated Si3N4 powder with nitrate additives, whereas the composition of heat-treated Si3N4 powder with oxide additives was similar to SiO2. Furthermore, a homogeneous distribution of the additives was achieved via the incorporation of aluminum and yttrium into the amorphous layer on the Si3N4 surface. The metal ratio (Y:Al) of the adsorbates was somewhat higher than that of the additives

[6] SYNTHESIS OF PHASE-PURE PB(ZNXMG1-X)(1/3)NB2/3O3 UP TO X=0.7 FROM A SINGLE MIXTURE VIA A SOFT-MECHANOCHEMICAL ROUTE

Shinohara S. Baek JG. Isobe T. Senna M. - Journal of the American Ceramic Society. 83(12):3208-3210,

Phase-pure perovskite Pb(ZnchiMg1-chi)(1/3)Nb2/3O3 solid solution (PZ(chi)M(1-chi)N) is obtained for chi less than or equal to 0.7 by heating a milled stoichiometric mixture of PbO, Mg(OH)(2), Nb2O5, and 2ZnCO(3) . 3Zn(OH)(2) .H2O at 1100 degreesC for 1 h. Percent perovskite (f(P)) with respect to total crystalline phase decreases with increasing temperature of subsequent heating then increases to 900 degreesC for the mixtures where chi less than or equal to 0.8 and milled for 3 h, For mixtures with chi = 0.9 and chi = 1,f(P) decreases monotonically. Curie temperature increases almost linearly with increasing chi up to chi = 0.7. The maximum dielectric constant at 1 kHz is 2 x 10(4) and 1.7 x 10(4) for the mixture with chi = 0.4 and chi = 0.7, respectively. The stabilization mechanism of strained perovskite is discussed.

[5] MECHANICALLY ACTIVATING NUCLEATION AND GROWTH OF COMPLEX PEROVSKITES

Wang J. Xue JM. Wan DM. Gan BK. - Journal of Solid State Chemistry. 154(2):321-328,

Mechanical activation of the constituent oxides at room temperature led to the formation of nanocrystalline Pb-based relaxor ferroelectrics and piezoelectrics of complex perovskite structure. The activation-triggered occurrence of complex perovskites,

such as Pb(Mg1/3Nb2/3)O-3, 0.9[0.4b(Mg1/3Nb2/3)O-3-0.6Pb(Zn1/3Nb2/3)O-3]-0.1PbTiO(3), and Pb(Zr0.52Ti0.48)O-3, in the mixed oxide compositions and in an amorphous precursor derived from coprecipitation proceeds via a profess involving nucleation and subsequent growth of perovskite crystallites with increasing degree of mechanical activation. This is fundamentally different from the one or more interfacial reactions and diffusions responsible for a thermally activated solid state reaction occurring at an elevated temperature. Nucleation occurs in a highly activated state, where a degree of amorphization has taken place, and the subsequent growth proceeds as a result of the constant collisions and rearrangement of perovskite nuclei

[4] EFFECT OF LOCAL PRESSURE ON THE CRYSTALLIZATION PRODUCT OF AMORPHOUS ALLOYS INDUCED BY MECHANICAL MILLING

Yao B. Liu L. Liu SE. Ding BZ. Su WH. Li Y. - Journal of Non-Crystalline Solids. 277(2-3):91-97,

[3] FORMATION OF NIAL-AL2O3 INTERMETALLIC-MATRIX COMPOSITE POWDERS BY MECHANICAL ALLOYING TECHNIQUE

Lin CK. Hong SS. Lee PY. - Intermetallics. 8(9-11 Special Issue SI):1043-1048,

This study investigated the feasibility of preparing intermetallic-matrix composite powders (NiAl/Al2O3) by mechanical alloying of Ni, Al and Al2O3 powder mixtures with Various compositions of (NiAl),(Al2O3)(100-x) The as-milled powders were examined by X-ray diffraction, scanning electron microscopy, and differential thermal analysis. The formation of NiAl phase was noticed after 5 h of milling. Intermetallic-matrix composite powders (NiAl/Al2O3) were prepared successfully at the end of milling for (NiAl)(x) (Al2O3)(100-x) (x=79, 66, and 49), but no alumina phase was detected for (NiAl)(95)(Al2O3)(5). It is suspected that the additions of alumina hampered the cold welding and fracturing process. The thermal analysis of (NiAl)(x)(Al2O3)(100-x) powders after 1 h of milling revealed that the transition temperature of NiAl phase increased with increasing amount of Al2O3 additions

[2] MICROSTRUCTURE AND MECHANICAL BEHAVIOR OF A MULTIPHASE AL3TI-BASED INTERMETALLIC ALLOY

Fu YY. Shi R. Zhang JX. Sun J. Hu GX. - Intermetallics. 8(9-11 Special Issue SI):1251-1256,

The mechanical properly of the monolithic Ll(2) Al3Ti alloy is unlikely to be improved by further alloying due to the very narrow composition range of the Ll(2) phase in the Al-Ti-X systems. Therefore, we have developed a Nb-modified multiphase Al3Ti-based alloy Al67Mn8Ti24Nb1, which has a Ll(2) matrix with dispersed Al-3(Ti, Nb) precipitates. High-energy ball milling was employed to fabricate the alloy in comparison with the conventional casting process. A sequence of metastable transitions occurred during the mechanical milling (MM) process. The microstructures of the bulk materials consolidated from powers with different starting metastable states have been studied. It was determined that the alloy consolidated with metastable FCC powder has a much higher strength and better fracture toughness than the cast Al67Mn8Ti24Nb1 alloy and the monolithic Ll(2) A(13)Ti alloys. The temperature dependence of yield strength and ductility also shows good results. SEM and TEM investigations were conducted to explore the mechanisms of strengthening and toughening

[1] HIGH COERCIVITY IN MECHANICALLY MILLED THMN12-TYPE ND-FE-MO NITRIDES

Zhang XD. Cheng BP. Yang YC. - Applied Physics Letters. 77(24):4022-4024,

Starting from carefully homogenized Nd10Fe90-yMoy (y=12, 10, 7) alloys and by appropriate mechanical milling, the as-milled microstructure consisting of a nanoscale mixture of severely distorted 1:12 phase and substitutional alpha -Fe-based solid solution was obtained. This kind of as-milled microstructure was thought to have a critical effect on the formation of iron-free nanocrystalline 1:12 phase during subsequent annealing. Upon nitrogenation, the sample of Nd10Fe78Mo12Nx exhibited a record-high coercivity of 13.1 kOe at 293 K. Measurements of initial magnetization curve and a family of demagnetization curves engendered under different maximum applied fields H-m were carried out, and the results revealed the domain-wall pinning at grain boundaries as the coercivity mechanism. A low Mo-content sample of Nd10Fe83Mo7Nx with (i)H(c)similar to5.8 kOe, B(r)similar to6.8 kG, and (BH)(max)similar to7.0 MG Oe was made by optimizing the preparation conditions

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Mecanosynthese et Activation Mecanique"
CNRS UMR 5060 Universite de Technologie de Belfort Montbeliard (UTBM) - 90010 Belfort Cedex

2) M. Boudina
synthese reactive des materiaux pour des applications aeronatiques a base de Ti-Al-Nb en utilisant de l'hydrogene.

3) Fumio Saito
Title: Mechanochemical Dissociation of HBB
Authors: Qiwu Zhang, Hiroki Matsumoto, Fumio Saito and Michel Baron*
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"Mécanismes et modélisation de transformations de phase induites par broyage dans TiO2"
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Effects de la contanination en oxygène et en azote gazeux sur les propriétés structurales et magnétiques des alliages Fe-Cr obtenus par mécanosynthèse.
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Method of operation:

With standard planetary ball mills the grinding bowls are rotating and mounted eccentrically on a rotating support disc. The rotational speed of the supporting disc can be selected at will; the grinding bowl rotates at a fixed transmission ratio.

Due to the overlapping of grinding bowls and supporting disc, the material to be ground and the grinding balls execute movements and trajectories in the grinding bowl, which are defined by the transmission ratio.

With the "pulverisette 4" vario-planetary mill the rotational speeds of grinding bowls and supporting disc can be adjusted completely independently of each other. By varying the transmission ratio it is possible to control the movements and trajectories of the grinding balls at will so that the balls strike the inner wall of the bowl vertically (high impact energy), approach each other tangentially (high friction) or just roll down the inner wall of the bowl (centrifugal mills).

All intermediate levels and combinations of frictional and impact pressures can be set as required. By changing the transmission ratio it is therefore possible for the first time to carry out mechanical activation as well as mechanical alloying.

Furthermore, it is also possible for the first time to optimally adjust a planetary ball mill to the material to be ground, the size of the grinding bowls and the grinding balls.

Features of performance:

• for the first time, all grinding parameters can be selected at will for optimal preparation of sample

• Programming of the grinding parameters by PC software as desired

• RS232 interface for programming and to transfer grinding parameters to the PC

• Real-time display of the speeds to monitor the grinding process

• Reversing option (direction of rotation reversed periodically) to improve the grinding results

• Emulation of various ball mills

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• Final fineness << 1 µm

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