

RESEAU FRANÇAIS DE MECANOSYNTHESE

Lettre N° 61

Avril 2000

175(+2) Groupes de Recherche
(dont 102(+2) à l'étranger / 35 Pays)

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

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PRIERE DE RENOUVELLER L'INSCRIPTION au RFM au titre de l'Année 2000
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SOMMAIRE

2 Nouvelles Adhésions

Technical Announcements from M.B.N. srl and Fritsch

Full Congress Announcements

Congress List (related to Nanomaterials)

Cooperation (PhD, Post Doc, International Relationships)

Books (related to Nanomaterials)

Bibliography

2 Nouvelles Adhésions

Q. Zhang - Institute for Advanced Materials Processing - Tohoku Univ. - Japon

F. Carli - Actimex Srl - Trieste - Italie

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'99 et quelques éléments mis à jour régulièrement concernant les derniers résultats dans ce domaine.

Autres Sites Web Intéressants

Website : <http://www.Lure.u-psud.fr/actus/avenir>

- Pour ceux intéressés par le devenir du Rayonnement Synchrotron en France / Europe, un site intéressant et particulièrement actif ces dernières semaines
- People interested by the Synchrotron Radiation Development in France / Europe

Technical Announcements

M.B.N.srl

(From Francesca Cagnoli - M.B.N.srl)

M.B.N. srl - via Roma, 4

I-31020 San Vendemiano (TV)

E-mail: mechano@tin.it // Web site: <<http://www.mbn.it>>

MBN srl, based in Italy, announces the availability of laboratory (kg range) as well as industrial quantities (ton range) of materials produced by mechanosynthesis. More information are available at the Web site: <<http://www.mbn.it/>> . Batches on-demand could be considered."

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FRITSCH: Your expert and specialist in the laboratory

(informations from A. Koehler - Fritsch)

FRITSCH is the world-wide leading manufacturer of instruments for sample preparation and particle size analysis in the laboratory. Since 80 years now, the company is concentrating on the three product groups and identified with the brand names of "pulverisette", "analysette" and "laborette" in research and industrial laboratories. The Fritsch name is synonymous with technical competence and economical efficiency in all matters in the field of **milling, particle sizing, dividing**.

Because **FRITSCH** operates throughout the world, they have the unique advantage of vast experience in a wide variety of scientific disciplines which enables them to offer constructive solutions to ease problem solving. **FRITSCH** laboratory instruments ensure proven reliability with innovative technology in combination with simple operation.

Also this year **FRITSCH** are again
from May 22nd-27th, 2000 in Frankfurt on the **ACHEMA**
in hall 6.1, booth no. J10-J12.

They are going to disclose the secret of their numerous new developments. Don't miss this great event. New design and a number of innovative and practice oriented developments are shown.

Here a small glance of our developments:

Mortar Grinder "pulverisette 2"

The Mortar Grinder, known as the traditional old *VW-Beetle* in the sample preparation ("... and runs and runs and runs..."), has now grown up into the new modern and comfortable new *VW-Beetle* and shows its innovative side in a new design.

Planetary Mill "pulverisette 5"

New model of the Planetary Mill with an exceptional high grinding energy and a wide range of accessories: the *Mercedes* on our exhibition booth.

Vario-Planetary Mill "pulverisette 4"

Our "erlking" on the **ACHEMA**: a Planetary Mill with absolutely new features of performance, specially developed for the material research, but also welcome in every High-tech laboratory. Power like a *Ferrari*, but with a lower price.

Variable Speed Rotor-Mill "pulverisette 14"

The Turbo Mill with real 20.000 rpm (who said *Porsche* ?) for the sample preparation; the new model have already earned positive appreciation in view to technical innovation and the individual interior fittings among the experts.

Cutting Mill Combination "pulverisette 25" "pulverisette 19"

For the pre- and fine crushing of plastic materials, waste and other soft to tough and more plastic or fibrous materials a very strong team is necessary: other mills look like a *pick-up* against a *truck with trailer*.

High-capacity analytical Sieve Shaker "analysette 18"

The *truck* under the Laboratory Sieve Shakers can classify a complete truckload of bulk material with sieves up to 400 mm diameter (at least some kg).

Dry Dispersing Unit for "analysette 22" Laser-Particle-Sizer

Finally, here it is – lively and powerful like a *BMW*-motor. The new dry dispersing unit ensures the latest state of the art technology in the sample feeding and enlarges considerably the range of applications of the Laser-Particle-Sizers **COMPACT** and **COMFORT**.

Drop in – you will be surprised.

Contact: **Fritsch GmbH** - Manufacturers of Laboratory Instruments
Andrea Köhler

Industriestrasse 8 - D-55743 Idar-Oberstein - Germany
Phone: ++49/67 84/70-46 / Fax: ++49/67 84/70-11
E-Mail: koehler@fritsch.de / Internet: <http://www.fritsch.de>

JRFM'2000

5èmes Journées du Réseau Français de Mécanosynthèse
23 et 24 Mai 2000 - Bordeaux, ICMCB

Thématique retenue

Caractérisations physico-chimiques des matériaux élaborés par mécanosynthèse

Conférences Invitées

- **Vers la Modélisation de la Mécanosynthèse**
Prof. Jacques FOCT, Université de LILLE

- **Elaboration et caractérisation de nanotubes élaborés par mécanosynthèse**
Dr Laurent CHAFFRON, CEA saclay-CEREM-SRMP/DTM, Gif sur Yvette

- **La Mécanosynthèse au Japon**
Prof. Associé Shin-Ichi ORIMO, Higashi Hiroshima University
Prof. Associé Koichi TSUCHIYA1, Toyohashi university
Prof. Etsuo AKIBA1, NIMC

Contacts et pre - inscriptions

Local Organization :

Dr. Jean-Louis BOBET
Institut de Chimie de la Matière Condensée de Bordeaux (ICMCB)
Avenue du Dr A. Schweitzer
33608 Pessac Cedex FRANCE
Tel : 33-(0)5-56-84-26-53 - Fax : 33-(0)5-56-84-24-80
E_Mel : bobet@icmcb.u-bordeaux.fr

Réseau Français de Mécanosynthèse

Dr. Eric Gaffet (Pdt of the RFM)
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E_Mel : Eric.Gaffet@utbm.fr

BULLETIN d'INSCRIPTION JRFM'2000

5 èmes Journées du Réseau Français de Mécanosynthèse
Bordeaux-Pessac (CNRS-ICMCB)
Les 23 et 24 Mai 2000

Thématique 2000 : Mécanosynthèse : caractérisation Physico-Chimiques

Fiche d'Inscription : (à renvoyer à Jean-Louis BOBET le plus tôt possible, avant le 31.01.2000)

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

Pour les laboratoires propres ou associés au CNRS, indiquer le code et l'adresse complète de l'Unité. Une facture sera établie directement à leur encontre.

Pour les agent CNRS merci d'**indiquer votre indice majoré** :
(nécessaire pour obtenir un discount pour les déjeuners!)

Frais d'inscription : (comprenant†: recueil des résumés, 2 déjeuners, 1 dîner)

Déjeuner du 23 mai oui / non

Banquet du 23 mai soir† oui / non (Prière d'entourer les réponses)

Déjeuner du 24 mai† oui / non

Tarifs

Etudiant(e)s en thèse : 100 FF Autres participant(e)s : 400 FF

Pour les fournisseurs et autres exposants, contacter directement E. Gaffet

Mode de paiement :

Dès réception du bulletin d'inscription dûment complété par vos soins (ou d'un bon de commande de votre organisme), une facture sera établie pour paiement : aucun règlement n'est à effectuer à l'inscription.

Rappel : le CNRS gérant ce colloque, il est fortement conseillé de privilégier le paiement par virement administratif du CNRS.

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Fiche d'inscription et résumés à retourner le plus tôt possible et avant le 31/01/2000 :

Jean-Louis BOBET (Journées RFM2000)

CNRS - Institut de Chimie de la Matière Condensée de Bordeaux

Av du Dr A. Schweitzer - 33608 Pessac Cedex

(Tel : 05.56.84.26.53 - fax : 05.56.84.24.80, E-mail : bobet@icmcb.u-bordeaux.fr)

Date limite d'Envoi des Résumés : 30 Avril 2000

Publications : Après sélection, les articles proposés pourront être publiés dans Journal of Metastable and Nanocrystalline Materials (J. Metastable & Nano. Mater. - Trans Tech Publ.)

Editors : A.R. Yavari, A. Inoue, R. Schulz, D. Morris

Int. Editorial Board, : J.H. Ahn, H. Bakker, M.D. Baro, R. Bormann., A. Calka, G. Cocco, J. Eckert, E. Gaffet, S. Gialenella, A. Hernando., A. Inoue, C. Koch, G. Le Caer, M. Magini, D. Morris, P.H. Shingu., L. Schultz, R. Schulz

IMPORTANT :

Les frais d'inscription ne comportent pas l'adhésion au RFM au titre de l'année 2000.

Pour participer aux JRFM2000, il est impératif d'envoyer votre cotisation de 100 FRF à l'ordre du RFM.

(Pour tout renseignements complémentaires sur cette adhésion contacter E. Gaffet).

Comité d'organisation

Jean-Louis Bobet

et toute l'équipe "Détermination structurale et matériaux magnétiques"

CNRS - ICMCB

(UPR 9048 CNRS - Université Bordeaux1)

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Inorganic Materials Conference
University of California Santa Barbara, USA,
13 - 16 September 2000
<http://www.elsevier.com/locate/im2000>

Call for Papers

The deadline for submission of 300 word abstracts for oral and poster presentation at the Second International Conference on Inorganic Materials is Friday 25 February 2000. Please submit your abstracts to the conference secretariat according to the guidelines set out in the First Announcement and on the conference website
<http://www.elsevier.com/locate/im2000>

Papers are invited in the following areas:

Electronic Materials;

Structural Materials and Ceramics;

Biomaterials; Intermetallics;

Catalytic and Porous Materials including simulation.

The Conference, which is organized by Elsevier Science in association with the International Journal of Inorganic Materials, takes place at the University of California Santa Barbara, USA, 13 - 16 September 2000 and will bring together many of the leading experts in the field to present and discuss their ideas. The Second Announcement, which will include program and registration information, will be available shortly: to receive a copy please contact the conference secretariat or complete the reply form on the conference website.

Sarah Wilkinson

SICIM Conference Secretariat

Email: sm.wilkinson@elsevier.co.uk

Web: www.elsevier.com/locate/im2000

MATERIALS WEEK
International Congress on Advanced Materials, their Processes and Applications
25 - 28 September 2000
ICM – International Congress Centre Munich in Conjunction with the Exhibition Materialica

Call for Papers

MATERIALS WEEK, the international congress on advanced materials, their processes and applications, to be held in conjunction with the exhibition MATERIALICA, looks back upon its very successful predecessor meetings Werkstoffwoche 98 and EUROMAT 99 which have strengthened the reputation of Munich as a premier European materials place. MATERIALS WEEK sets out to become the most comprehensive European event to demonstrate the wide range of the interdisciplinary performance of materials.

The conference programme is essentially focused on applications of materials with high innovation potential. At the same time, fundamental approaches and processing related aspects for unconventional materials are addressed.

Papers can be submitted now! The deadline is 3 April 2000.

Get detailed information and the call text on the Internet and submit your paper there:
www.materialsweek.org

Dr. Thomas Karsch
Project Coordinator
Materials Week
Werkstoffwoche-Partnerschaft GBRmbH
Hamburger Allee 26
D-60486 Frankfurt
Tel +49-69-7917747
Fax +49-69-7917733
e-mail tk@dgm.de

J2IM 2000

“**Joints Intergranulaires et Interphases dans les Matériaux**”

Fontainebleau - EDF (Site des Renardières)

4 - 6 Octobre 2000

Première circulaire - Inscription

La thématique principale du colloque sera :

“Interfaces Contraintes - Effets de l’environnement”

Voici les premières informations concernant cette manifestation, accompagnées d’un formulaire d’inscription.

• Le colloque se tiendra au site EDF des Renardières, *cet établissement mettant aimablement ses locaux à notre disposition*. Les déjeuners auront lieu sur place. L’hébergement se fera à l’hôtel IBIS à Fontainebleau (réservations par notre intermédiaire). Des autobus assureront les transports matin et soir de l’hôtel au site du colloque (et vice-versa).

• Les frais d’inscription comprenant la participation au colloque, l’hébergement, les repas (y compris le dîner/banquet du jeudi 5 octobre) seront de 1300F pour un hébergement en chambre double. Un supplément de 380F sera demandé aux participants souhaitant être logés en chambre simple.

Adresse de retour : J2IM 2000 - c/o Jacky Ruste
Département Etude des Matériaux
EDF - Site des Renardières - route de Sens - Ecuelles
77818 Moret sur Loing
Fax : 01 60 73 63 69 **e-mail :** jacky.ruste@edf.fr

A partir de fin Mars, vous trouverez toutes les informations sur cette rencontre, régulièrement mises à jour, sur le site Web : <http://perso.club-internet.fr/adjr/j2im.html> . Vous y trouverez les résumés des communications

PROGRAMME DU COLLOQUE (extraits scientifiques)

“ Effets d’irradiation sur les Matériaux “

J.C. Van Duysen, Chef du Département études des Matériaux (EMA)

Sous thème I : Interfaces contraintes dans divers matériaux

Interfaces, Contraintes, Déformations : quelques points de repère

Amand Georges et Alain Jacques (Ecole de Mines de Nancy)

Les modes de relaxation des couches minces à fort désaccord paramétrique

Pascale Bayle-Guillemaud (DRFMC, CENG, Grenoble)

Dislocations intergranulaires et déformation de l’alumine

Sylvie Lartigue-Korinek (LEMHE, Université Paris Sud, Orsay)

Variation des concentrations de défauts ponctuels dans et proche des interfaces métal-oxyde avec le potentiel chimique d’oxygène

Monika Backhaus (CECM Vitry, CNRS, actuellement à Cornell University)

Phénomènes aux interfaces ferrite/austénite et lois de comportement mécanique

Brigitte Décamps (LCMTR, CNRS, Thiais)

Approche par simulation de la structure, de la ségrégation et de la diffusion aux joints de grains d’alliages Fer-aluminium

Remy Besson (Université Lille I)

Etude par Dynamique Moléculaire de l’Interface Solide –Liquide

Pascale Geysersmans (CECM Vitry, CNRS)

Sous thème II : Interfaces enterrées

Réalisations de structures par adhésion moléculaire

H. Moriceau (LETI, CEA)

Les interfaces dans les batteries Lithium/polymère et l’interface carbone /epoxy dans les lignes aériennes

A. Aslanides (CIMA, EDF)

Interfaces GaN sur substrat carbure de silicium ou alumine - Défauts induits dans le volume

G. Nouet (LERMAT, Caen)

Influence des contraintes sur la cinétique de croissance des couches développées sur un alliage NiCr

Gaëlle Calvarin (LEMHE, Orsay/ENSMP, Evry)

Sous thème III : Effets de l’environnement

La corrosion sous contrainte des alliages de zirconium par l’iode - cas de l’interaction pastille-gaine en service et de l’entreposage du combustible

E. Walle (EDF, Université de Lille 1)

Modélisation de l’endommagement intergranulaire des gaines de combustibles en condition d’interaction pastille - gaine

O. Diard (EDF, /ENSMP)

"Scattering Studies of Mesoscopic Scale Structure and Dynamics in Soft Matter"

Messina Italy

22th to 25th of November 2000

(Informations from Francesco Mallamace and Sow-Hsin Che)

With the patronage of the Foundation U. Bonino and M.S. Pulejo - Messina

Main Topics:

Light, Neutron and X-ray Scattering studies of: Colloids, Polymer & Polymer solutions, Gels and Sol-Gel Transition, Micelle and Microemulsion Systems, Macromolecules of Biological Interest, Water, Glassy Systems, Phase Separation Phenomena.

Conference includes invited speakers, contributing speakers and poster sessions.
Selected papers will be published.

Conference Chairs:

Francesco Mallamace (University of Messina) and Sow-Hsin Chen (MIT Cambridge)

International Organizing Committee

Sow-Hsin Chen (MIT-Cambridge), Marie Claire Bellissent (Saclay), Kenneth Dawson (Dublin), Rudolf Klein (Konstanz), Francesco Mallamace (Messina), Nicole Ostrowsky (Nice), Takao Ohta (Hiroshima), Alberto Robledo (Mexico), Piero Tartaglia (Rome I).

Invited Speakers (Preliminary)

Piero Baglioni (Florence Univ.-Italy), Marie Claire Bellissent (LLB Saclay-France), Lesser Blum (Puerto Rico Univ.) Antonio Coniglio (Naples Univ.-Italy), Mario Corti (Milan Univ.-Italy), Kenneth Dawson (Dublin Univ.-Ireland), Charles Han (NIST-USA), Benjamin S. Hsiao (SUNY-Stony-Brook-USA), Heinz Hoffmann (Bayreuth Univ.-Germany), Rudolf Klein (Konstanz Univ.-Germany), Kell Mortensen (RISO-Denmark), Koichi Ohta (Hiroshima Univ.-Japan), Nicole Ostrowsky (Nice Univ.-France), Giorgio Parisi (Rome I -Italy), Maria Antonietta Ricci (Rome III-Italy), Alberto Robledo (UNICAM-Mexico), Jacques Rouch (Bordeaux Univ.-France), Giancarlo Ruocco (L'Aquila Univ.-Italy), Francesco Sciortino (Rome I-Italy), Sunil K. Sinha (IPNS Argonne-USA), H.Eugene Stanley (Boston Univ.-USA), Reinhard Strey (Koln Univ.-Germany), Toyochi. Tanaka (MIT Cambridge-USA), P. Tartaglia (Rome I, Italy), Jose Teixeira (LLB Saclay-France), Roberto Triolo (Palermo Univ.-Italy), Sidney Yip (MIT Cambridge-USA), David Weitz (Harvard Univ. Cambridge-USA).

Local Committee

Norberto Micali, Guglielmo Mondio and Valentina Venuti (Messina).

Conference Address:

Prof. Francesco Mallamace, Dipartimento di Fisica Università di Messina, Vill. S. Agata C.P. 55, 98166 MESSINA, Italy. Tel.+30-090-6765016/391478. Fax +30-090-395004. Email: mallamac@imeuniv.unime.it

Prof. Sow-Hsin Chen, Department of Nuclear Engineering, Massachusetts Institute of Technology, 24-209, Massachusetts Av. 77, MA, USA. Tel. +1-617-253-3810. Fax +1-617-258-8863. Email: sowshin@mit.edu

Sponsors:

Fondazione Bonino Pulejo, Massachusetts Institute of Technology, Università di Messina, Gruppo Nazionale di Struttura della Materia del CNR.

**2000 MRS Fall Meeting
27 Nov - 1 Dec. 2000
Boston - Massachusetts - USA**

Symposium L

The supercooled liquid state of the alloys can be tailored to transform to two functionally important classes of novel materials: bulk metallic glasses (BMG) and bulk nanocrystalline materials, depending on whether the crystal nucleation frequency can be pushed to the extremes of less than $1 \text{ cm}^{-3} \text{ s}^{-1}$ and greater than $14 \text{ cm}^{-3} \text{ s}^{-1}$, respectively. Crystal growth rates are also important. The composition and temperature-time windows that allow formation of BMG or nanocrystalline materials depend on liquidus (T_l), glass transition (T_g), and crystallization (T_x) temperatures, thermodynamic quantities, such as crystal-interfacial energy σ and free energy driving force (G for homogeneous vs heterogeneous crystal nucleation, as well as phase-separation phenomenon. Viscosity of the supercooled liquid and its temperature dependence, liquid alloy packing density, and volume change (ΔV) during crystallization are also important.

BMG and nanocrystalline alloys are known to have attractive functional properties, including high mechanical strength, wear resistance and polymer-like formability between T_g and T_x , unique magnetic properties, and corrosion resistance. It is, therefore, timely to organize this symposium in order to bring together scientists active in phase diagram calculations and thermal measurements, thermodynamics and kinetics of phase transformations, liquid-state structure and properties, mechanical, magnetic, chemical, and other properties of BMG and nanocrystalline materials, as well as scientists and engineers from the industry interested in the various applications of these materials.

Following the 1999 MRS Fall Meeting symposium on BMG and other international BMG symposia, this symposium builds on the previous meetings that clearly evidenced the need for simultaneous consideration of BMG formation and nanocrystalline materials.

Topical areas of interest include, but are not limited to:

Bulk glassy and nanocrystalline alloys
Phase diagram calculations
Phase transformation kinetics and thermodynamics
Liquid-state structure and properties
Glass-forming ability and thermal stability
Viscoelastics and transport properties
Ultrasoft and hard magnetism
Mechanical properties
Properties and applications
Novel processing methods

Invited speakers (tentative) include: R. Busch (Oregon State Univ.); M. Calvo Ulf. Dahlborg (Mines, Nancy, France); P.J. Desre (CNRS-UMR); J. Eckert (IFW Dresden); F. Faupel (Univ. Keil); E. Gaffet (CNRS- UPR); U. Geyer (Univ. G'ttingen); C.J. Gilbert (Univ. of California); A. Hernando (Univ. Complutense de Madrid); N. Hirotsu (Osaka Univ.); K. Hono (NRIM); M. Imafuku (ERATO); Y. Kawamura (Tohoku Univ.); M. Knobel (Campinas Brazil); C.C. Koch (North Carolina Univ.); U. K'ster (Dortmund Univ.); H.W. Kui (Chinese Univ. Hong Kong); Y. Li (Natl. Univ. Singapore); S. Linderoth (Ris' National Lab); C.T. Liu (Oak Ridge National Lab); B.M. Ma (Rhodia Inc.); A. Makino (Akita Prefect. Univ.); E. Matsubara (Tohoku Univ.); H. Nakajima (Osaka Univ.); N. Nishiyama (ERATO); J. Perepoko (Wisconsin); J. Saida (ERATO); J. Schroers (Caltech); R.B. Schwarz (Los Alamos National Lab); R.W. Siegel (Rensselaer Polytechnic Inst.); and C. Suryanarayana (Colorado School of Mines).

Send abstracts to MRS (see <http://www.mrs.org> by mail/fax for June 5th or by e-mail for June 19th)

A. R. Yavari

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W. L. Johnson

California Institute of Technology, MS138-78, 1200 E. California Blvd., Pasadena, CA 91125, Tel 626-395-4433, Fax 626-795-6132

R. H. Dauskardt

Stanford University, Dept. of Materials Science and Engineering, Bldg. 550, Rm. 550G, Stanford, CA 94305-2205, Tel 650-725-0679, Fax 650-725-4034

MRS MATERIALS RESEARCH SOCIETY

9800 Mc Knight Road
Pittsburgh, Pennsylvania 15237

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

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JRFM'2000

23 - 24 Mai 2000 - Bordeaux France
Wbesite : <http://www.bls.fr/amatech>

III European Conference on Fluidization

29 - 31 Mai 2000 - Toulouse - France
E_Mail : Progep@ensigct.fr

PM2 TEC2000

2000 International Conference on Powder Metallurgy & Particulate Materials
31 Mai - 3 Juin 2000 - New York - USA
Contact : MPIF

4th EUROMECH

26 - 30 Juin 2000 - Metz - France
E_Mail : euromech@lpmm.univ-metz.fr
WebSite : <http://www.lpmm.univ-metz.fr/euromech>

ISMANAM 2000

International Symposium on Metastable Mechanically Alloyed and Nanocrystalline Materials
9 - 14 Juillet 2000 - St Catherines College - Oxford UK
E_Mail : ismanam2000@materials.ox.ac.uk
website : <http://www.materials.ox.ac.uk/OCAMAC/ISMANAM/ismanam2000.html>

NCM8

**8th International Conference on the Structure of
Non - Crystalline Solid**

6 - 11 Aout 2000
Website : <http://www.sgt.org>

XIVth International Symposium on the Reactivity of Solids

Budapest, Hungary through 27-31 August 2000
<http://www.jate.u-szeged.hu/~isrs14>

Solid State Chemistry 2000

Prague, Czech Republic, September 3 - 8,2000

and
3rd INCOME

International Conference on Mechanochemistry and Mechanical Alloying

Prague, Czech Republic, September 4 - 8,2000
Organised by the Institute of Inorganic Chemistry (UACH), Czech Republic
WebSite : <http://www.iic.cas.cz/INCOME.htm>

Inorganic Materials Conference

NOUVEAU

University of California Santa Barbara, USA
13 - 16 September 2000 <http://www.elsevier.com/locate/im2000>

MATERIALS WEEK

**International Congress on Advanced Materials,
their Processes and Applications**

NOUVEAU

25 - 28 September 2000
ICM – International Congress Centre Munich in Conjunction with the Exhibition
Materialica
website : www.materialsweek.org

J2IM 2000

**“Joints Intergranulaires et Interphases
dans les Matériaux“**

NOUVEAU

Fontainebleau - EDF (Site des Renardières)
4 - 6 Octobre 2000

<http://perso.club-internet.fr/adjr/j2im.html>

**Nanomatériaux :
Vers les Applications Industrielles**

**Nanomaterials :
Towards Engineering Applications**

Colloque : France - Etats Unis - Canada
22 - 25 Octobre 2000 - Montréal, Canada
Contacts : Champion@glvt-cnrs.fr et/ou Eric.Gaffet@utbm.fr

PM 2000

**Powder Metallurgy World
Congress & Exhibition**
12 - 16 Novembre 2000 Kyoto - Japon
Contact : Fax : 81 - 3 - 3423 - 1600

**The 1st International Conference on Advanced Materials Processing
Rotorua, New Zealand, 19-23 November 2000.**

Secretary, ICAMP 2000,
Department of Materials and Process Engineering The University of Waikato
Private Bag 3105, Hamilton, New Zealand
Fax: 64-7-838 4835, e-mail: d.zhang@waikato.ac.nz
Or visit the conference web site:
<http://mape.waikato.ac.nz/conferences/amp.htm>

NOUVEAU

**"Scattering Studies of Mesoscopic Scale
Structure and Dynamics in Soft Matter"**

Messina Italy
22th to 25th of November 2000
(see above for details)

2000 MRS Fall Meeting

27 Nov - 1 Dec. 2000
Boston - Massachusetts - USA
(see above for details)

PM2 TEC2001

**2001 International Conference on Powder Metallurgy
& Particulate Materials**
13 - 17 May 2001 - New Orleans - USA
Contact : MPIF

SOUTENANCE DE THESE

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)

**Structure dans les matériaux élaborés sous HIP : cas des alliages à base tungstène 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	Directeur de Recherche, LURE Orsay	Rapporteur
F. NARDOU	Professeur, Université de Limoges	Rapporteur
D. VREL	Chargé de Recherche, Université de Villetaneuse	Examineur
M.F. BEAUFORT	Chargé de Recherche CNRS, LMP Poitiers	Examineur
M. GROSBAS	Chargé de Recherche CNRS, LMP Poitiers	Examineur
J. MIMAUULT	Professeur, Université de Poitiers	Examineur et Directeur de Thèse

RESUME

Ce travail est constitué de deux études distinctes sur la structure de matériaux élaborés dans une enceinte HIP. La première étude a pour but de décrire les microstructures obtenues sur des alliages base tungstène, en prenant une phase additive constituée de nickel, fer et éventuellement cobalt, lors d'essais de frittage en phase solide. Des comparaisons entre les différents essais sont effectuées en fonction des conditions de préparation choisies : durée du broyage, composition des mélanges, mélange de la poudre de tungstène et de la phase additive au turbula ou par broyage, température de frittage etc.

Le premier chapitre est consacré à une revue bibliographique décrivant les différents résultats publiés sur le sujet. Les choix expérimentaux de préparation que nous avons été amené à faire en tenant compte de l'étude bibliographique menée sont présentés dans le deuxième chapitre. Ensuite, nous procédons à l'analyse par microscopie électronique à balayage (MEB) et par analyse par dispersion d'énergie (EDS-X), aussi bien sur les poudres broyées que sur les matériaux obtenus après mise en température et pression. Puis l'organisation structurale de la matière est décrite au moyen d'expérience de diffraction des rayons X (DRX) et de spectroscopie d'absorption des rayons X (EXAFS). Pour ces deux chapitres, une étude préliminaire des effets du broyage sur la morphologie et structure d'une poudre de référence, le nickel, est menée. Le dernier chapitre est consacré à la deuxième étude qui a pour objet la mise au point de la presse isostatique en vue de l'élaboration de matériaux par combustion auto-propagée (SHS). Les premiers essais réalisés sur le mélange $Ti+C\ddagger TiC$ et la caractérisation structurale des matériaux obtenus sont présentés dans ce chapitre.

ABSTRACT

This work is composed of two studies about structure of materials elaborated under HIP. The aim of the first study is to describe the microstructure observed in tungsten alloys, with a matrix phase composed of nickel, iron and possibly cobalt, during solid phase sintering. Microstructure are compared in term of preparation condition : time of milling, composition, mixing with two different devices (shaker or planetary ball milling), sintering temperature. First a bibliographic synthesis about tungsten alloy microstructure is presented. In a second part, the experimental choices are exposed in correlation with the bibliographic study. Then, the microscopy study (SEM) and the quantitative analysis (EDS-X) of the milled powder and the sintered materials are presented. In the fourth part, the structural organisation is described by of X-ray diffraction (XRD) and X-ray spectroscopy (EXAFS). A preliminary study about the milling effects on the morphology and cristalline structure on a reference nickel powder is also proposed in these two parts. The second study is presented in the last part. The aim of this study is the ajustement of the HIP processing device in ordre to elaborate materials by SHS. The first tries were carried out at pressure of 1 to 500 bars and the structure caracterisation are presented too.

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, Directeur de Recherche, Ecole des Mines - Nancy (Rapporteur), Marc NOGUÈS, Chargé de Recherche, Université de Versailles (Rapporteur), Jean-François BÉRAR, Ingénieur de Recherche, CNRS - Grenoble, Frédéric BERNARD, Maître de Conférence, Université de Bourgogne - Dijon, Jean-Yves BUZARÉ, Professeur, Université du Maine - Le Mans, Marc LEBLANC, Professeur, Université du Maine - Le Mans, Jean-Marc GRENNÈCHE, Directeur de Recherche, Université du Maine (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 materiaux presentee a l'Universite de Picardie Jules Verne

Jury : M. le Prof. J. Etourneau (Universite Bordeaux) M. D. Fruchart (DR, Lab. Cristallographie, Grenoble) Mme A. Percheron - Guegan (DR, LCMTR, Thiais) M. le Prof. L. Schlapbach (Universite de Fribourg) M. le Prof. J.-M. Tarascon (Universite de Picardie) M. L. Aymard (Universite de Picardie)

F.Charlot

**Etude et compréhension des réactions auto-entretenuées activées mécaniquement. Elaboration
du composé FeAl nanostructuré.**

6 Déc. 1999 - Université de Technologie de Belfort - Montbéliard

Nanomatériaux : Elaboration et Transitions de Phases Hors Equilibre, UPR 806 CNRS, UTBM - Sévenans.

Matériaux à Grains Fins, LRSS UMR 5613 CNRS-Université de Bourgogne.

Jury (Provisoire) : G. Bertrand, G.LeCaer (Rapp.) , F.Thévenot (Rapp.) , F.Bernard (Co - Dir.), E.Gaffet (Co - Dir.), J.C.Gachon, M.Bessière, M.Gailhanou

Frédéric BERNARD

25 Novembre 1999 - Amphi de l'ESIREM - Dijon

**De l'introduction de " mécanique " dans l'élaboration de la poudre au massif nanométrique vers la maîtrise des
propriétés thermomécaniques.**

Jury :D.LOUER, Directeur de Recherches CNRS(Université de Rennes II) rapporteur H. VAN DAMME, Professeur (Université d'Orléans) rapporteur J.C. TEDENAC, Professeur (Université de Montpellier II) Rapporteur J. FOCT, Professeur (Université de Lille) G. LE CAER , Directeur de recherches CNRS (Ecole des Mines, Nancy) G. BERTRAND, Professeur (Université de Bourgogne) A. NONAT, Directeur de Recherches CNRS (Université de Bourgogne) J.C. NIEPCE, Professeur (Université de Bourgogne)

Frédérique PERROT-SIPPLE

17 Novembre 1999 - Université de Bourgogne - Dijon

**Maîtrise de la taille de nanograins d'oxydes de structure perovskite
pour applications électrocéramiques:**

- Synthèse par chimie douce,- Broyage par attrition.

Jury : M. J.-M. HAUSSONNE Professeur, Ecole d'Ingénieurs de Cherbourg M. A. ROUSSET Professeur, Université de Toulouse M BEAUGER Alain Ingénieur de Recherche et Développement TPC Saint Apollinaire M. BERTRAND Gilles Professeur, Université de Bourgogne M. CHARTIER Thierry Chargé de Recherche, ENSCI de Limoges M. HUGENTOBLER Denis Directeur Stratégie et Développement ligne céramique, TPC Saint Apollinaire M. MUTIN Jean-Claude Directeur de Recherche, Université de Bourgogne Mme RIEUX Nadine Ingénieur de Recherche Alstom- PERT, Massy **Directeurs de thèse**:M. D. AYMES Maître de Conférences, Université de Bourgogne M. P. PERRIAT Professeur, INSA de Lyon

H. SOUHA

Thèse de Doctorat d'Etat Marocaine

Faculté des Sciences Dahr El Mehrz Fes.

**Elaboration par recuit et par réaction de combustion du composé Cu₃Si à partir d'un mélange de poudres
activées mécaniquement. Réactivité du composé Cu₃Si vis à vis du chlorure cuivreux.**

Jury :B. Gillot, G. Bertrand, F. Bernard (Co - Dir.), E. Gaffet (Co - Dir.)

O. Held

**"Etude des réactions de combustions solide-solide ou solide liquide auto-entretenuées pour différents
intermétalliques du système Al-Ni-Ti.**

Elaboration de ces mêmes intermétalliques par broyage mécanique et étude de leur cinétique de cristallisation
Nancy, Faculté des Sciences, le 5/11/99.

Jury : J. L. Jorda, J. M. Moreau, P. Satre, J. C. Gachon, F. A. Kuhnast, F. Bernard, J. F. Bézar, M. Bessière.

D. Cracco

**"Recherche de Nouveaux Alliages Hydrurables de Forte Capacité Massique
Utilisable comme Matériaux d'Electrode Négative d'Accumulateur Ni - MH"**

CNRS - Thiais - France - 25 Juin 1999

Jury : B. Darriet, L. Schlapbach, B. Knosp, R. Portier, A. Percheron - Guégan

A. Gentil - Sagot

**Amélioration de la tenue au fluage d'un alliage d'argent (AIC)
par introduction d'une dispersion d'oxydes.**

Elaboration par Métallurgie des Poudres
Ecole des Mines - Paris - 17 Juin 1999

Jury : M. Grosbras, L. Charrin, S. Kleine, D. Havart, J. - L. Strudel, Y. Bienvenu

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 : HYPERLINK mailto: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.

**Ph D Position and Post Doc Position
Requests - Proposals**

**FRANCE (14 / 02 / 2000)
Ph D Thesis Proposal**

A partir de septembre 2000 (Bourse du Ministère)

"Obtention par mécanosynthèse de mélanges composites à base de magnésium ayant des propriétés d'hydruration optimisées. Caractérisation de leurs propriétés structurales et physiques.

En résumé, le sujet proposé portera sur les deux points suivants :

- 1 - Etude de mélanges composites Mg (ou Mg₂Ni) + intermétalliques élaborés par mécanosynthèse (structure, composition chimique, capacités d, absorption d, hydrogène, morphologie, surface, granulométrie,);
- 2 - Réalisation d'électrodes négatives à partir de ces mélanges et études électrochimiques.

Les techniques utilisées au cours de ce travail seront* :

Préparation : - Broyeur planétaire - Four à lévitation - Four à arc - Banc d'hydruration (construction de courbe PCT)
Caractérisation : - Diffraction des rayons X sur poudres - Microsonde électronique - Microscopie électronique (à balayage et en transmission) - Mesures de surfaces spécifiques (BET) - Granulométrie (diffraction Laser - "Mesures" électrochimiques - Mesures calorimétriques XPS, EPMA, ...

* ceci est une liste non exhaustive des différentes techniques que le candidat devra utilisé

Contact :

Jean-Louis BOBET

Associate professor - Institut de Chimie de la Matière Condensée de Bordeaux Avenue du Dr A. Schweitzer
33608 Pessac Cedex FRANCE

Tel : 33-(0)5-56-84-26-53 Fax : 33-(0)5-56-84-24-80 e mail : bobet@icmcb.u-bordeaux.fr

USA (8 / 02 / 2000)

Rutgers University is seeking a **postdoctoral associate** with demonstrated expertise in powder synthesis and processing (forming and sintering methods) to work on research focused on textured ceramic ferroelectric materials. The candidate must be able to work as part of a multidisciplinary team involving industry and academia focused on making transducer and actuator materials. The candidate should demonstrate the ability to work independently, publish in archival journals and present their work in a public forum. The candidate should send a curriculum vitae, three representative publications (preferably with the candidate as a first author) and the names, addresses, email and phone numbers of three references that can comment on the candidate's capabilities. The position is available immediately at a salary of \$32,000 with health benefits included. The position is available immediately. Placement is preferred prior to August with priority given to a qualified candidate with earlier availability.

Interested candidates should send correspondence to: Professor Richard E. Riman, Rutgers University, Department of Ceramic and Materials Engineering, 607 Taylor Road, Piscataway, NJ 08854-8065, riman@alumina.rutgers.edu / 732-445-4946 / 732-445-6264

COREE du SUD (10 / 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 : HYPERLINK mailto:shhong@sorak.kaist.ac.kr / shhong@sorak.kaist.ac.kr
Fax. : 82-42-869-3310 - Tel. : 82-42-869-3327

The Composite Materials Laboratory at Korea Advanced Institute of Science and Technology is looking for a postdoctoral position. The postdoctoral contract will be one year on the field of modeling and simulation of mechanical & thermal properties of composite materials or on the field of fabrication process of nano-composite materials. Applicant should be within three years of receipt of Ph.D. degree on related field. For more information, please contact :

ISRAEL (13 / 10 / 1999)

***** Postdoctoral Position Available for a Ph.D Physicist (13th October 1999)**

The High-Pressure (HP) group of the School of Physics & Astronomy at Tel Aviv University has a one year position available. This position could be extended to two years.

The HP group is known worldwide as one of the leading groups in experimental HP physics and is on the frontier of HP and diamond-anvil-cells based methodology. The main methods used are:

Mössbauer spectroscopy

X-ray diffraction with synchrotron radiation (ESRF, Grenoble) resistivity

Applicants must be between the final stage of dissertation and within three years of receipt of Ph.D diploma.

For more information, please contact:

Dr. Moshe P. Pasternak

School of Physics and Astronomy

Tel Aviv University - 69978 Tel Aviv, ISRAEL - email: hh136@ccsg.tau.ac.il

FRANCE (2/07/99)

Joindre Pascal Viel , tél 01 69 08 41 47 CEA SRSIM Bt 461, 91191 Gif sur yvette

Proposition de post doc qui débiterait idéalement en septembre 99. Le financement du post doc est acquis (1 an) Le lieu de travail est le centre de Saclay (DSM/DRECAM/SRSIM) Le sujet concerne une étude très appliquée sur la dépollution des eaux de rejets industriels : Mise au point et étude d'un procédé d'élimination des métaux lourds basé sur la fabrication d'un filtre actif (complexation-décomplexation) utilisant la modification de surfaces métalliques par des films polymères électrogréffés en couches minces.

Conditions: avoir sa thèse depuis moins d'un an, ne pas avoir été salarié depuis sauf pour un an de postdoc à l'étranger et avoir moins de 30 ans

Bibliographie Récente

Livres ou "Special Issues"

NOUVEAU (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

DISPERSION STRENGTHENED ALUMINIUM PREPARED BY MECHANICAL ALLOYING, by M Besterici

<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/cambsci/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 equilibrium processing methods and their effects in a single volume.

web site : 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.ttp.net>

Interest in bulk amorphous alloys has increased rapidly throughout the world 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 (Ti,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, covering 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 Besterčí, 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@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

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

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

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

CHEMISTRY FOR SUSTAINABLE DEVELOPMENT

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

Proceedings of 2d International Conference on Mechanochemistry

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

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

Mechanochemistry of Materials
Cambridge International Science Publishing

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

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

BIBLIOGRAPHY ON MECHANICAL ALLOYING AND MILLING

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

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

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

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

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

PERIODIQUES

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

[51] ATOMIC AND LARGE SCALE STRUCTURE OF METASTABLE CRYSTALLINE AND AMORPHOUS ZR75NI25 SYSTEM

Al-Assiri M. Al-hajry A. - Physics of Low-Dimensional Structures. 12:97-106, 1999

Melt spinning technique has been used to produce metastable crystalline phase of Zr75Ni25 alloy at low quenching rate. Mechanical Milling (MM) technique has been used to transform such a system to an amorphous phase. The milling time needed for such transformation was found to be 8 hours. X-ray diffraction was used to investigate the atomic structure of the sample. The crystallization temperature of such an alloy was obtained by differential scanning calorimetry (DSC). Crystalline intermetallic compounds were obtained by post heat treatment of the MM Zr75Ni25 amorphous sample. The large scale structure of the parent and the amorphous samples was studied by small angle neutron scattering (SANS). The results of SANS showed that the structure of both phases is fractal.

[50] KINETICS AND MECHANISMS OF PHASE TRANSFORMATIONS INDUCED BY BALL-MILLING IN ANATASE TiO2

Begin-Colin S. Girot T. Le Caer G. Mocellin A. - Journal of Solid State Chemistry. 149(1):41-48, 2000

Ball-milling is a way of inducing phase transformations, chemical reactions, and changes in the reactivity of solids. It is a complex process for which several models have been developed to predict the evolution of systems and to describe its physics. These models sometimes empirically need experimental data to be ascertained and to confirm general theories of system evolutions. In this work, we investigate the effect of two milling parameters, the powder to ball weight ratio R and the nature of the grinding media, on the kinetics of phase transformations in anatase TiO₂ powder. These experiments established that R affects only the reaction rate. The kinetics are faster with alumina than with steel grinding tools for a given R, specific injected powers being similar. It has been demonstrated that the phase transformations induced by grinding TiO₂ occur without fracturing of particles and mechanisms are commented upon.

[49] THE EFFECT OF CO ADDITION ON Mg2Ni ALLOY HYDRIDE ELECTRODES PREPARED BY SINTERING AND FOLLOWED BY BALL MILLING

Sun L. Wang GX. Liu HK. Bradhurst DH. Dou SX. - Journal of New Materials for Electrochemical Systems. 2(4):211-214, 1999

In this paper, we have investigated the effect of Co addition on Mg₂Ni alloy hydride electrodes prepared in two different ways: 1) by ball milling (BM) the Mg₂Ni alloy prepared by sintering a mixture of Mg and Ni powders with Ni or Co powders; and 2) by ball milling Mg₂Ni_{0.6}Co_{0.4} alloy prepared by sintering a mixture of Mg, Ni and Co powders with Ni powders. The results show that the sintered Mg₂Ni alloy ball-milled with Ni or Co powders can achieve an amorphous structure. The Mg₂Ni_{0.6}Co_{0.4} alloy ball-milled with Ni powders for 60 hours can also obtain an amorphous structure. The formation of an amorphous alloy structure is a key factor in order to obtain high initial discharge capacities. The addition of Co to amorphous Mg₂Ni alloys can increase their crystallisation temperatures and alter the initial discharge capacity but the Co addition has no effect on their cycle life. Increasing the ball milling time is an effective method of obtaining further improvements in the initial discharge capacity of Mg-based alloys.

[48] FABRICATION OF Ag/Bi2SR2CA1CU2O8 +/- X SUPERCONDUCTING TAPES BY THE OXIDATION AND POSTOXIDATION (PARTIAL MELT) ANNEALING OF MALLEABLE, METAL-BEARING PRECURSORS

Detrie TJ. Sandhage KH. - Journal of Materials Research. 15(2):306-316, 2000

A solid metal-bearing precursor route has been used to fabricate Ag-sheathed Bi₂Sr₂Ca₁Cu₂O₈+/-x (2212) superconducting tapes. Intimately mixed Bi₂O₃-Sr-Ca-Cu-bearing powder was first synthesized by a two-stage, high-energy/low-energy mechanical alloying process. The powder was then packed into silver tubes and formed into tapes by drawing and biaxial (Turk's-head) rolling. The precursor tapes were oxidized and converted into Ag-sheathed 2212 by heat treatment at 350-860 degrees C in oxygen. Subsequent annealing at 897 degrees C, followed by slow cooling and subsolidus annealing at 850 degrees C, yielded 2212 grains with enhanced c-axis alignment. The resulting tapes exhibited average and maximum transport J(c) (4.2 K, self-field) values of 3.2 x 10⁴ and 6.8 x 10⁴ A/cm², respectively.

[47] SYNTHESIS OF NANOSTRUCTURED WC-12 PCT CO COATING USING MECHANICAL MILLING AND HIGH VELOCITY OXYGEN FUEL THERMAL SPRAYING

He JH. Ice M. Dallek S. Lavernia EJ. - Metallurgical & Materials Transactions A-Physical Metallurgy & Materials Science. 31(2):541-553, 2000

A nanostructured WC-12 pct Co coating was synthesized using mechanical milling and high velocity oxygen fuel (HVOF) thermal spraying. The variation of powder characteristics with milling time and the performance of the coatings were investigated using scanning electron microscope (SEM), X-ray, transmission electron microscope (TEM), thermogravimetric analyzer (TGA), and microhardness measurements. There is no evidence that indicates the presence of an amorphous phase in the sintered WC-12 pct Co powder, and the binder phase in this powder is still crystalline Co. Mechanical milling of up to 20 hours did not lead to the formation of an amorphous phase in the sintered WC-12 pct Co powder. During the initial stages of the milling, the brittle carbide particles were first fractured into fragments and then embedded into the binder phase. This process gradually formed polycrystal nanocomposite powders of the Co binder phase and W carbide particles. The conventional cold welding and fracturing processes primarily occurred among the Co binder powders and polycrystal composite powders. The nanostructured WC-12 pct Co coatings, synthesized in the present study, consist of an amorphous matrix and carbides with an average particle diameter of 35 nm. The coating possesses an average microhardness of 1135 HV and higher resistance to indentation fracture than that of its conventional counterpart.

[46] SYNTHESIS OF NANOSTRUCTURED CR3C2-25(NI20CR) COATINGS

He JH. Ice M. Lavernia EJ. - Metallurgical & Materials Transactions A-Physical Metallurgy & Materials Science.

31(2):555-564, 2000

On the basis of the nanocrystalline Cr₃C₂-25 (Ni₂₀Cr) feedstock powders produced by mechanical milling, a nanostructured coating has been synthesized using high velocity oxygen fuel (HVOF) thermal spraying. The properties of the nanostructured coating were compared to those of the conventional coating of the same composition using scanning electron microscope (SEM), transmission electron microscope (TEM), and microhardness tests. The nanostructured Cr₃C₂-25 (Ni₂₀Cr) coating synthesized in this study had an average carbide particle size of 24 nm. Discontinuous elongated amorphous phases were observed in the nanostructured coating. The conventional Cr₃C₂-25 (Ni₂₀Cr) coatings produced using blended elemental powders exhibited an inhomogeneous microstructure. The observed homogeneity of the nanostructured coating is attributed, in part, to the microstructural improvement of the starting powder. The nanostructured Cr₃C₂-25 (Ni₂₀Cr) coating yielded an average microhardness value of 1020 DPH300, which corresponds to a 20 pct increase in microhardness over that of the conventional coating. The nanostructured Cr₃C₂-25 (Ni₂₀Cr) coating also exhibited a higher apparent fracture toughness relative to that of the conventional coating. The apparent mechanical property improvements in the nanostructured coating were thought to result from the uniformity of the microstructure and the high performance associated with a nanostructured structure. In addition, the mechanism that is present during the milling of a system containing nondeformable particles is discussed in light of the TEM observations.

[45] A NOVEL CASTING FORMING FOR CERAMICS BY GELATINE AND ENZYME CATALYSIS

Xie ZP. Chen YL. Huang Y. - Journal of the European Ceramic Society. 20(3):253-257, 2000

A new kind of gelation process for forming a ceramic green body is discussed. The forming method is based on a process in which gelatine, enzyme (urease) and urea are used. Urea is employed to prevent attraction between gelatine molecules when the dissolved hot gelatine solution cools down for preparing a well-dispersed suspension by ball milling and degassing at ambient conditions. After urease is added into the suspension, gelatine molecules attract each other and form three-dimensional network through hydrogen bonding due to urea decomposition by urease. Slurry containing alumina and gelatin could be consolidated in situ by the above gelation process at room temperature. A green body with homogeneous microstructure and smooth surface was obtained.

[44] FABRICATION OF AG/Bi₂Sr₂Ca₁Cu₂O₈+/- X SUPERCONDUCTING TAPES BY THE OXIDATION AND POSTOXIDATION (PARTIAL MELT) ANNEALING OF MALLEABLE, METAL-BEARING PRECURSORS

Detrie TJ. Sandhage KH. - Journal of Materials Research. 15(2):306-316, 2000

A solid metal-bearing precursor route has been used to fabricate Ag-sheathed Bi₂Sr₂Ca₁Cu₂O₈+/-x (2212) superconducting tapes. Intimately mixed Bi₂O₃-Sr-Ca-Cu-bearing powder was first synthesized by a two-stage, high-energy/low-energy mechanical alloying process. The powder was then packed into silver tubes and formed into tapes by drawing and biaxial (Turk's-head) rolling. The precursor tapes were oxidized and converted into Ag-sheathed 2212 by heat treatment at 350-860 degrees C in oxygen. Subsequent annealing at 897 degrees C, followed by slow cooling and subsolidus annealing at 850 degrees C, yielded 2212 grains with enhanced c-axis alignment. The resulting tapes exhibited average and maximum transport J(c) (4.2 K, self-field) values of 3.2 x 10⁴ and 6.8 x 10⁴ A/cm², respectively.

[43] IMPACT INDUCED PHASE TRANSFORMATION IN SHAPE MEMORY ALLOYS

Chen YC. Lagoudas DC. - J. Mech. Phys. Solids. 48(2):275-300, 2000

A dynamic analysis is given of the impact induced phase transformation in a shape-memory alloy rod, with a special focus on the propagation of stress waves and phase transformation fronts in the rod. The material behavior of the shape-memory alloy is modelled by a thermomechanical constitutive theory developed by Lagoudas et al. (1996: A unified thermodynamic constitutive model for SMA and finite element analysis of active metal matrix composites. Mechanics of Composite Materials and Structures 3, 153-179), which is based on the formulation of Gibbs free energy that depends on, among other variables, the martensitic volume fraction and the transformation strain, along with evolution equations derived from a dissipation potential theory. Field equations and jump conditions of the fully coupled thermal-mechanical problem are derived to account for balances of linear momentum and energy. The equations are solved using the method of characteristic curves. The solutions are found to be associated with shocks, across which various field quantities suffer jump discontinuities. A typical solution involves two wave fronts which are initiated at the impact surface and propagate into the rod. One, travelling at the acoustic speed, separates the tranquil and disturbed regions, The other, travelling at a lower speed, separates the regions of the martensitic and austenitic phases. It is found that the stress and temperature jumps across the phase boundary can be significant. A numerical example is presented.

[42] THERMOELECTRIC PROPERTIES OF THE HOT-PRESSED (Bi_{0.2}Sb_{0.8})₂TE-3 ALLOY WITH ADDITION OF BN AND WO₃ POWDERS

Lee JS. Oh TS. Hyun DB. - Journal of Materials Science. 35(4):881-887, 2000

Thermoelectric properties of the (Bi_{0.2}Sb_{0.8})₂Te-3 alloy, fabricated by mechanical alloying and hot-pressing, were investigated with addition of BN and WO₃ powders as phonon scattering centers. The Seebeck coefficient and the electrical resistivity of the hot-pressed (Bi_{0.2}Sb_{0.8})₂Te-3 alloy increased with increasing the volume fraction of BN and WO₃. Although the thermal conductivity of the hot-pressed (Bi_{0.2}Sb_{0.8})₂Te-3 alloy decreased with increasing the volume fraction of BN and WO₃ due to the reduction of kappa(e), the lattice thermal conductivity was not lowered. The figure-of-merit of the hot-pressed (Bi_{0.2}Sb_{0.8})₂Te-3 alloy, 3.05 x 10⁻³/K without addition of BN and WO₃, decreased with increasing the volume fraction of BN and WO₃, because the increment of the electrical resistivity was much larger than the decrement of the thermal conductivity due to the grain refinement.

[42] TRANSITION OF GAMMA-AL₂O₃ INTO ALPHA-AL₂O₃ DURING VIBRO MILLING

Kostic E. Kiss SJ. Zec S. Boskovic S. - Powder Technology. 107(1-2):48-53, 2000

The results obtained in studying the phase transition of gamma- into alpha-Al₂O₃ during intense mechanical activation by vibro milling are presented in this paper. It was found that depending on experimental conditions, the gamma --> alpha-Al₂O₃ transition through delta- and theta-phases, can be initiated. X-ray and SEM analyses of activation products show that the phase transition is preceded by intense reduction of gamma-phase particles. The

produced α - Al_2O_3 crystallites have a distorted lattice and are larger than the initial crystallites in the starting powder. The change of specific surface area (S-p) with activation time shows the presence of high internal porosity of γ - Al_2O_3 which disappears during the complex process of the phase transition. An attempt was made to present the specific surface area change via its γ - and α -phase contributions. In this respect, detailed analyses of γ - Al_2O_3 particle size reduction along with reduction of their internal porosity and agglomeration of ground powder were performed, which explain the change of the specific surface area with activation time.

[41] MECHANISM AND KINETICS OF MECHANOCHEMICAL PROCESSES IN COMMINUTING DEVICES - 1. THEORY

Urakaev FK. Boldyrev VV. - Powder Technology. 107(1-2):93-107, 2000

For the models built up on the basis of the nonlinear elastoplastic theory describing the collisions of solids, parameters of impact interaction between the working bodies and the material to be treated have been calculated for a series of comminuting devices, i.e., different types of ball mills, disintegrator, etc. Pressure and temperature impulses at the contacts of the treated particles have been calculated. Generalised equations have been deduced for the kinetics rate constants of mechanochemical reactions and for the mechanical activation of the substances in comminuting devices.

[40] THE BREAKAGE INDUCED BY A SINGLE GRINDING BALL DROPPED ONTO A RANDOMLY PACKED PARTICLE BED

Potapov AV. Campbell CS. - Powder Technology. 107(1-2):108-117, 2000

This paper describes some computer simulations of the breakage induced in a two-dimensional particle bed by the descent of a single large grinding ball. These are approximate experiments related to ball-milling that are tractable by the simulation technique (i.e., involve relatively few particles). As a result of the impact of the grinding ball, the particles in the bed are broken and/or scattered away from the grinding ball as it falls. Simulations were performed for four different bed depths and three different frictions. Generally, the deeper the bed, the less the total amount of breakage. The results show also show the dual role that friction plays in the breakage process. On one hand, the majority of the grinding ball's energy is lost to friction so that increasing the friction increases this energy loss. On the other hand, the friction holds the bed together and the larger the friction, the longer the bed stays in place for the grinding ball to do its work. It appears that this latter effect is the stronger of the two in that increasing the particles' coefficients of surface friction greatly increases the amount of breakage; that extra energy for breakage appears to come from a reduced kinetic energy of the scattered fragments.

[39] COMMUNION OF A BRITTLE/DUCTILE MATERIAL IN A MICROS RING MILL

Larsson I. Kristensen HG. - Powder Technology. 107(1-2):175-178, 2000

Wet milling of ibuprofen in a Micros Type 0 ring mill resulted in particle sizes which passed through a minimum of about 10 μm during milling independent of rotation speed. The apparent size enlargement may be due to plastic deformation and compression of fine particles. According to literature, the critical diameter characterising the brittle/ductile transition of ibuprofen is about 850 μm . Compression of single polycrystals revealed, however, that the particle size of ibuprofen had to be reduced to 125-355 μm in order to see plastic deformation. Thus, the study demonstrates that the ring mill is capable of comminuting particles to sizes well below the brittle/ductile transition.

[38] SOL-GEL ALUMINA COATINGS FOR WHISKER REINFORCED METAL MATRIX COMPOSITES

Ding DY. Rao JC. Wang DZ. Ma ZY. Geng L. Yao CK. - Materials Science & Engineering A-Structural Materials Properties Microstructure & Processing. 279(1-2):138-141, 2000

There exist serious interfacial reactions in squeeze-casting aluminum berate whisker reinforced 6061Al composites. To control the spinel reactions a sol-gel coating method was used to deposit γ - Al_2O_3 and α - Al_2O_3 ceramic coatings on aluminum berate whiskers. TEM observations of coating morphology indicate that nanostructured alumina coatings are uniformly deposited on whisker surfaces, with a thickness of about 30-50 nm. Ball-milling has an important effect on final mechanical properties of the composites. γ - Al_2O_3 and α - Al_2O_3 coatings were found to be effective in controlling the interfacial reactions, by completely preventing the diffusion of magnesium from matrix/coating interface to coating/whisker interface.

[37] INFLUENCE OF THE NATURE OF COMPONENTS MECHANICALLY ACTIVATED MIXTURE OF ZIRCONIUM ON SILICON OXIDES ON SOLID-PHASE SYNTHESIS OF ZIRCON

Avvakumov EG. Chizhevskaya SV. Stoyanov ES. Povetkina MV. Chekmarev AM. Shafirov VL. Vinokurova OB. - Russian Journal of Applied Chemistry. 72(9):1498-1502, 1999

The effect of hydration of zirconium and silicon oxides on solid-phase synthesis of zircon ZrSiO_4 with mechanical activation of their equimolar mixture and subsequent calcination at 1200 degrees C was studied. The optimal composition of the oxides, ensuring the maximum yield of zircon, was determined

[36] DEVELOPMENT OF ADSORBENTS FOR ADSORPTION PURIFICATION OF PROCESS GASES TO REMOVE FLUORINE COMPOUNDS

Il'in AP. Prokof'ev VY. Sazanova TV. Kochetkov SP. - Russian Journal of Applied Chemistry. 72(9):1573-1576, 1999

Operation of an adsorbent based on calcium hydroxide and carbonate in purification of process gases to remove fluorine was analyzed. Mechanochemical activation of calcium hydroxide and carbonate was studied together with structural-mechanical properties of materials in the stage of extrusion molding

[35] PREPARATION AND CHARACTERIZATION OF $\text{Pb}(\text{Zr}_{0.52}\text{Ti}_{0.48})\text{O}_3$ CERAMICS FROM HIGH-ENERGY BALL MILLING POWDERS

Kong LB. Zhu W. Tan OK. - Materials Letters. 42(4):232-239, 2000

Ultra-fine $\text{Pb}(\text{Zr}_{0.52}\text{Ti}_{0.48})\text{O}_3$ powder has been synthesized from the commercial PbO , TiO_2 and ZrO_2 powders using the high-energy ball milling technique in air at room temperature without any post-annealing. The synthesized powders milling for different hours are characterized using XRD, SEM, TEM and Raman spectra. XRD patterns and Raman spectra show that the perovskite phase of PZT can be formed from the mixture of the starting materials after milling for 20 h. The grain sizes of the powders have been estimated from the XRD patterns and TEM images to be similar to 10 nm. The relationship between the microstructure of the PZT powders and the milling hours has been

discussed. The PZT ceramics are derived for the synthesized powders by sintering the green pellets at 1100 degrees C for 1 h. The dielectric properties of the PZT samples are comparable with those of the same composition PZT prepared by other methods, but the high-energy ball milling process is much easier than other reported methods. The high-energy ball milling method offers a very attractive advantage of avoiding the loss of volatile elements, such as Pb, Bi, in the procedure of synthesis of nano-powders with their uniform compositions.

[34] SIMULTANEOUS IR AND TIME-RESOLVED X-RAY DIFFRACTION MEASUREMENTS FOR STUDYING SELF-SUSTAINED REACTIONS

Bernard F. Gaffet E. Gramond M. Gailhanou M. Gachon JC. - Journal of Synchrotron Radiation. 7(Part 1):27-33, 2000

Self-propagating high-temperature synthesis 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 time-resolved X-ray diffraction, with an X-ray synchrotron beam (D43 beamline, LURE, Orsay) coupled to simultaneous IR thermography to study structural transformations and thermal evolution. With short acquisition times (30 ms per pattern) it has been possible to observe several steps before obtaining compounds. Two different compound formations have been described: (i) the different steps of reaction, aluminium melting, subsequent temperature increase and fast reaction between Al and Ni at such temperatures that only Ni and AlNi are solid and all other compositions are liquid and well identified; (ii) the formation of FeAl. Here, a portion of the iron seems to transform into its allotropic phase and this transition stabilizes the reaction temperature at similar to 1173 K. In addition, the aluminium melting during the reaction explains why the nanostructure induced by the mechanical activation is maintained in the end product.

[33] THE FERROMAGNETIC TRANSITION IN MNAS SYNTHESIZED BY MECHANICAL ALLOYING AND POWDER BLENDING TECHNIQUES

Chernenko VA. Wee L. McCormick PG. Street R. - Journal of Materials Science. 35(3):613-616, 2000

A study of the structure and properties of MnAs synthesized by mechanical alloying and powder blending techniques has been carried out. Mechanical alloying resulted in the formation of MnAs during milling. Following heat treatment samples prepared using both techniques exhibited a magnetostructural transformation from the paramagnetic B31 to the ferromagnetic B8(1) phase with decreasing temperature or increasing magnetic field. The transformation temperatures and fields were found to depend on milling procedure and heat treatment conditions. Powder blended and heat treated samples exhibited excellent stability during transformation cycling.

[32] MECHANICAL ACTIVATION AS INITIATION OF COAL SELF-IGNITION

J Medek, Z Weishauptova - PROSPECTS FOR COAL SCIENCE IN THE 21ST CENTURY, VOLS I AND II, 1999, pp 495-498 - 10TH INTERNATIONAL CONFERENCE ON COAL SCIENCE; TAIYUAN, PEOPLES R CHINA. SEPTEMBER 12-17, 1999

A new theory of the self-ignition of coal was developed, based on the principle of the spontaneous disintegration of coal resulting from the effect of potential energy which is accumulated in the coal mass and causes mechanical stress. This leads to the formation of microcracks where a part of the potential energy is dissipated to heat under formation of microfires as primary centres of burning.

[31] COAL LIQUEFACTION BY USING THE COMMINUTED BINARY CATALYST OF METAL SULFIDES BY MECHANICAL MILLING

Y Kuriki, K Uchida, S Ohshima, M Yumura, F Ikazaki - PROSPECTS FOR COAL SCIENCE IN THE 21ST CENTURY, VOLS I AND II, 1999, pp 839-842 - 10TH INTERNATIONAL CONFERENCE ON COAL SCIENCE; TAIYUAN, PEOPLES R CHINA. SEPTEMBER 12-17, 1999

Effect was investigated of binary metal sulfide comminuted in a media-agitation mill on hydrogenation of 1-methylnaphthalene and coal liquefaction of Tanito Harum Indonesia coal. Binary metal sulfide such as MoS₂-CoS and MoS₂-NiS was comminuted. The sample prepared by comminuting such binary metal sulfide had hydrogenation and coal liquefaction better than expected from those using comminuted individual metal sulfide, which indicates a synergistic effect in comminution.

[30] MECHANICAL ACTIVATION OF PFBC-ASHES FOR HOT FLUE GAS CLEANING

P Schulle, R Wolf, B Meyer - PROSPECTS FOR COAL SCIENCE IN THE 21ST CENTURY, VOLS I AND II, 1999, pp 1409-1412 - 10TH INTERNATIONAL CONFERENCE ON COAL SCIENCE; TAIYUAN, PEOPLES R CHINA. SEPTEMBER 12-17, 1999

In this paper the investigations using mechanically activated ashes to reduce the alkalis in a hot flue gas, at high pressure up to 1.3 MPa and a temperature of 850 degrees C, will be reported. In a laboratory test program, the potential of several mechanically activated ashes, which are used as additives for the flue gas purification, was tested. The activated ashes were subjected to X-ray diffraction, thermal analysis and determination of the specific surface and adsorption heat. In the case of ashes with a high quartz content, the improvement in reactivity was particularly marked after mechanical activation, with a strong decrease in crystallinity and crystallite size accompanied by a slight increase in crystal lattice distortions. For ashes with higher contents of anhydrite and lime, mechanical activation mainly influence the adsorptive capacity. Besides these studies, a test facility was designed and constructed. In this test plant a simulated gas with the same composition of a PFBC combustion gas, can be produced. The gas cleaning process is carried out in a pressurized entrained flow reactor. The loaded ashes are removed from flue gas by using a back-pulsed ceramic filter candle. The alkali concentration of the ashes is determined by atomic absorption spectrometry. Experiments for alkali removal were carried out in a test facility under PFBC-conditions. The sodium removal efficiency of FBC-ashes could be increased by mechanically activation. Sodium capture efficiencies of activated ashes up to 95 % have been achieved.

[29] COMBUSTION SYNTHESIS OF MICRON-SIZED SM₂CO₁₇ PARTICLES VIA MECHANOCHEMICAL PROCESSING

W Liu, PG McCormick - RARE EARTHS '98 (Series: MATERIALS SCIENCE FORUM), 1999, Vol 315-3, pp 552-561 - INTERNATIONAL CONFERENCE ON RARE EARTHS; FREMANTLE, AUSTRALIA. OCTOBER 25-30, 1998

The spontaneous formation of Sm₂Co₁₇ micron-sized particles via a mechanically induced combustion reaction has been investigated. Sm₂Co₁₇ alloy particles of 0.1 - 2 μm in size embedded in a CaO matrix formed directly via a combustion reaction induced by milling the powder mixture of Sm₂O₃, CoO, CaO and Ca for a critical time. The micron-sized Sm₂Co₁₇ particles were found to have the TbCu₇-type structure and were characterized by a coercivity of 7.8 kOe while embedded in the CaO matrix. The effect of subsequent heat treatment on the structure and magnetic properties of as-milled samples was studied. Removal of the CaO by a carefully controlled washing process yielded micron-sized Sm₂Co₁₇ particles without significant oxidation of the particles. These fine Sm₂Co₁₇ particles can be used to produce anisotropic bulk or bonded magnets.

[28] SYNTHESIS OF ULTRAFINE Ce₂S₃ POWDER BY MECHANOCHEMICAL PROCESSING

T Tsuzuki, PG McCormick - RARE EARTHS '98 (Series: MATERIALS SCIENCE FORUM), 1999, Vol 315-3, pp 586-591 - INTERNATIONAL CONFERENCE ON RARE EARTHS; FREMANTLE, AUSTRALIA. OCTOBER 25-30, 1998

The synthesis of ultrafine Ce₂S₃ powder by mechanochemical processing has been studied using X-ray diffraction, surface area measurements and transmission electron microscopy. Mechanical milling of a stoichiometric mixture of CeCl₃ and CaS powders caused the solid state displacement reaction of 2CeCl₃ + 3CaS → Ce₂S₃ + 3CaCl₂ to occur in a steady-state manner, forming Ce₂S₃ nanoparticles in a CaCl₂ matrix. After a simple washing process to remove the CaCl₂ by-product, tetragonal beta-Ce₂S₃ nanoparticles of 20 - 200 nm were obtained. Using CaCl₂ diluent and mechanically alloyed CaS in the starting mixture resulted in the formation of cubic gamma-Ce₂S₃ nanoparticles with sizes of 10 - 80 nm.

[27] HARD MAGNETIC NANOPARTICLES AND NANOCOMPOSITES

A Giri, K Chowdary, SA Majetich - ADVANCED HARD AND SOFT MAGNETIC MATERIALS (Series: MATERIALS RESEARCH SOCIETY SYMPOSIUM PROCEEDINGS), 1999, Vol 577, pp 197-207 - 1999 MRS SPRING MEETING; SAN FRANCISCO, CALIFORNIA. APRIL 5-9, 1999

Many high performance permanent magnets are nanostructured materials. The magnetic properties of nanoparticles are discussed in terms of characteristic length scales, including the maximum monodomain size and the exchange length. Experimental results for ball milled SmCo₅ nanoparticles are presented, showing deviations from idealized behavior. Because of the short exchange length, this can be understood in terms of independent nucleation of reverse domains in grains within larger particles. With a much longer exchange length, FeCo alloy nanoparticles show reduced coercivity in a high density compact, in accordance with the random anisotropy model. The SmCo₅ and FeCo nanoparticles were mixed and compacted in an attempt to make an exchange spring nanocomposite. However, significant exchange between the hard and soft phases was not observed because the sample density was too low. Processing considerations for improved co-compaction of these nanoparticles are discussed.

[26] THE KINETICS OF FORMATION OF NANOCRYSTALLINE GAMMA-NI-FE DURING MECHANOCHEMICAL SYNTHESIS

P Knorr, BS Kim, JS Lee - ADVANCED HARD AND SOFT MAGNETIC MATERIALS (Series: MATERIALS RESEARCH SOCIETY SYMPOSIUM PROCEEDINGS), 1999, Vol 577, pp 409-414 - 1999 MRS SPRING MEETING; SAN FRANCISCO, CALIFORNIA. APRIL 5-9, 1999

An experimental study of the kinetics of the three partial processes involved in the mechano-chemical synthesis of nanocrystalline (nc) Ni-Fe is presented. These processes are the reduction of nc NiO, the reduction of nc Fe₂O₃, and the alloying of Ni and Fe to a gamma-Ni-Fe solid solution. For the reaction rates of the reduction of nc NiO and nc Fe₂O₃ activation enthalpies of 82 kJ mol⁻¹ and 47 kJ mol⁻¹ were obtained. The progress of the overall synthesis was found to follow the sequence NiO red. → Fe₂O₃ red. →, gamma-Ni-Fe form

[25] SHOCK ACTIVATION AND HOT-PRESS SINTERING OF Si₃N₄ POWDER

XG Zhou, FY Lu, QY Cai - ADVANCED MATERIALS & PROCESSES PREPARING FOR THE NEW MILLENNIUM (Series: INTERNATIONAL SAMPE TECHNICAL CONFERENCE SERIES), 1999, Vol 31, pp 549-556 - 31ST INTERNATIONAL SAMPE TECHNICAL CONFERENCE ON ADVANCED MATERIALS AND PROCESSES PREPARING FOR THE NEW MILLENNIUM; CHICAGO, ILLINOIS. OCTOBER 26-30, 1999

In this paper, Si₃N₄ powders have been pre-treated by shock activating and then through hot-press sintering Si₃N₄ ceramics have been fabricated. Three kinds of shock pressure, and three different sintering temperatures are used in the experiments, SEM, TEM and X-ray Diffraction have been used to analysis the structure of the Si₃N₄ powders and ceramics. The properties of Si₃N₄ ceramic have been tested. The results show that shock activation give positive action to the densification of Si₃N₄ powder and the increase of properties of the Si₃N₄ ceramics; the ceramic parts shocked under 40 GPa and sintered under 1800 degrees C have the best properties. The bend strength reaches 1107.2 MPa, at the same time, the fracture toughness reaches 12.20 MPa.m^{1/2}.

[24] CHARACTERIZATION OF NANOSTRUCTURED TI BASED INTERMETALLICS

HA Calderon, V GaribayFebles, A Cabrera, M Umemoto, JG CabanasMoreno, K Tsuchiya - ADVANCED MATERIALS FOR THE 21ST CENTURY: THE 1999 JULIA R WEERTMAN SYMPOSIUM, 1999, pp 431-441 - 1999 JULIA R WEERTMAN SYMPOSIUM ON ADVANCED MATERIALS FOR THE 21ST CENTURY AT THE 1999 TMS FALL MEETING; CINCINNATI, OHIO. OCTOBER 31-NOVEMBER 4, 1999

Production, microstructural characterization and measurement of mechanical properties of nanocrystalline Ti-Al alloys are reported. Mechanical alloying and plasma-assisted sintering are used to produce these materials. The alloys investigated include TiAl_{1+X} and TiAl_{3+X} where X represents Cr, Mn or Fe. Mechanically alloyed powders have a microstructure consisting of an amorphous matrix and small crystalline domains. X-ray diffraction, conventional and high resolution transmission electron microscopy (TEM and HREM) are used to identify the crystallites and the amorphous matrix after different milling times. The plasma-assisted sintering technique allows production of solid specimens with low porosity. Sintered specimens have a crystalline microstructure with nanosized grains. Alloys based on TiAl-X are composed mainly of the phases alpha(2) (DO19) and gamma (L1(0)), homogeneously distributed in the form of nanograins. Al₃Ti-X alloys are composed of only one cubic phase (L1(2)). Mechanical properties (hardness and compression tests) measured at room temperature are reported as a function of alloy content and grain

size for both types of alloys. TEM is used to characterize the deformation mechanism. Compression tests of Al,Ti-X show no plasticity and fracture appears before any plastic behavior. However, a high fracture stress is found for the Cr and Mn-containing alloys. No dislocation activity has been identified most likely owing to the small grains produced in these alloys. The TiAl-X alloys present plasticity and have some dislocation activity owing to the relatively larger grain sizes observed.

[23] MECHANICAL MIXING AND THE DEVELOPMENT OF NANOCRYSTALLINE MATERIAL DURING THE SLIDING OF METALS

DA Rigney, JE Hammerberg - ADVANCED MATERIALS FOR THE 21ST CENTURY: THE 1999 JULIA R WEERTMAN SYMPOSIUM, 1999, pp 465-474 -- 1999 JULIA R WEERTMAN SYMPOSIUM ON ADVANCED MATERIALS FOR THE 21ST CENTURY AT THE 1999 TMS FALL MEETING; CINCINNATI, OHIO. OCTOBER 31-NOVEMBER 4, 1999

Sliding contact of metals causes dramatic structural and chemical changes in the material adjacent to the interface. Details vary considerably for different choices of materials and sliding conditions. However certain common features are well documented in the tribological literature. Careful studies of worn surfaces and of cross-sections provide evidence of large plastic strains and strain gradients and large strain rates and strain rate gradients. There is also good evidence for transfer, reactions with chemical species in the environment and mechanical mixing processes which affect friction and wear. In certain materials systems, these processes can generate an amorphous layer at the interface. However, more typical is the generation of nanocrystalline material near the sliding interface and in the wear debris. This is not surprising in view of reports that many processes that involve intense plastic strains generate nanocrystalline structures. Two- and three-dimensional molecular dynamic (MD) simulations using more than 6×10^4 atoms help us to understand how this nanocrystalline material is generated during sliding. In particular, they reveal that the mechanically mixed layer and the nanocrystalline material have the same thickness, suggesting a mechanism for the generation of nanocrystalline material by mechanical processes during sliding.

[22] MICROSTRUCTURE AND MECHANICAL PROPERTIES OF MECHANICALLY ALLOYED AND HIP-CONSOLIDATED Fe₃Al

Zhu SM. Iwasaki K. - Materials Transactions Jim. 40(12):1461-1466, 1999

Blended elemental Fe and Al powders were mechanically alloyed in a high energy attritor-type ball milling system. After 100 h milling, a Fe(Al) solid solution with bcc structure was formed in the powders. An ultra-high pressure (1 GPa) hot isostatic pressing (HIP) facility was used in an effort to consolidate the mechanically alloyed powders into fully dense compacts while retaining the nanocrystalline microstructure. Fully dense Fe₃Al compacts with a grain size of 180 nm were obtained by HIP treatment at 1073 K, whilst a 973 K HIP treatment produced nearly full density Fe₃Al compacts with a grain size of 80 nm. Mechanical properties of the HIPed compacts were evaluated by compression tests from room temperature to 1073 K and compared with those of a coarse-grained cast Fe₃Al alloy. The 973 K HIPed compact exhibited a yield strength as high as 2.3 GPa at room temperature, but it suffered from poor ductility. The 1073 K HIPed compact appears promising due to a combination of significantly higher strength, both at room temperature and at elevated temperatures, as well as better room temperature ductility than its cast counterpart.

[21] MICROSTRUCTURAL CHARACTERISTICS OF ULTRAFINE DISPERSION STRENGTHENED CU-CUO CENTER DOT AL₂O₃ MATERIAL [CZECH]

Orolinova M. Durisin J. Durisinova K. Katana V. Besterci M. - Kovove Materialy-Metallic Materials. 37(6):377-385, 1999

The work is aimed at study of changes of microstructural characteristics of Cu-CuO . Al₂O₃ material depending on the volume portion of dispersoid. Nanocrystalline powder mixtures with the dispersoid amounts from 1 to 10 % vol, were prepared by the original mechano-chemical method [1, 2]. In individual stages of preparation of the powder mixtures, a change of the morphology of Cu-particles takes place. With the increasing volume portion of the secondary phase, the structure of the powder Cu-matrix is refined. In compact materials deformation texture is formed during extrusion, however, with the increasing amount of the dispersoid it is suppressed.

[20] NOVEL ROUTE TO SUBMICROMETER TUNGSTEN CARBIDE

Welham NJ. -AICHE Journal. 46(1):68-71, 2000

A mixture of graphite and scheelite (CaWO₄) have been mechanically milled together for 40 h. The resultant powder and an unmilled powder were examined by thermal analysis, isothermal annealing, and X-ray diffraction to determine the effect of milling on the reduction of scheelite to tungsten carbide. The milled powder underwent a rapid reduction reaction at 800 degrees C-300 degrees C lower than the unmilled powder. The reduction sequence to WC was shown to differ for the two powders with W₂C intermediate in the milled powder and W in the unmilled powder. The milled powder showed complete reduction to WC in 1 h at 1,000 degrees C, whereas the unmilled powder was incompletely reduced, even after 1 h at 1,200 degrees C. Separation of the final phases was readily achieved by a simple acid leach, leaving WC grains around 200 nm in size.

[19] AMORPHOUS PHASE FORMATION IN FE-6.0WT%SI ALLOY BY MECHANICAL ALLOYING

Filho AF. Bolfarini C. Xu Y. Kiminami CS. - Scripta Materialia. 42(2):213-217, 1999

[18] STUDIES ON SURFACE MOLECULAR MOTION OF OLIGOMERIC POLYSTYRENE BY DIFFERENTIAL SCANNING CALORIMETRY

Zhang XM. Tasaka S. Inagak N. - Polymers for Advanced Technologies. 11(1):40-47, 2000

There are many studies on the surface molecular motion of polymer films [1], but no report on surface thermal properties of polymer because of experiment nl difficulties. The thermal property of oligomeric polystyrene (PS) was investigated by differential scanning calorimetry (DSC) in the present study. In order to increase the ratio of surface area to volume of PS particles, the DSC samples were prepared by mechanically grinding mixtures of PS and Al₂O₃ powders. The grinding mixtures of these powders with low particle size showed a transition at a low temperature of 14-17 degrees C (much lower than the bulk glass transition temperature, T-g), and this low-temperature transition was dependent on the size of PS particles. This transition seems to result from the surface molecular motion of the

activated surface layer of PS.

[17] MECHANICAL ENHANCEMENT OF THE CARBOTHERMIC FORMATION OF TiB₂

Welham NJ. - Metallurgical & Materials Transactions A-Physical Metallurgy & Materials Science. 31(1):283-289, 2000

A mixture of rutile, boron oxide, and graphite has been mechanically milled for 1, 10, and 100 hours with the intention of forming titanium diboride during subsequent thermal treatment. The resultant powders were examined after isothermal annealing by X-ray diffraction (XRD) to determine the effect of milling on the formation of TiB₂. No reaction was found to occur during milling, even for milling times of 100 hours. Annealing of the milled samples resulted in the formation of TiB₂ at temperatures as low as 1000 degrees C for the 100 c-hour milled powder. The reaction mechanism during thermal processing changed with milling time, with TiBO₃ predominant in samples milled for >1 hour, whereas Ti₂O₃ phases predominated for 1 hour of milling. Titanium carbide became an increasingly abundant intermediate phase with longer milling times, but was converted to TiB₂ at high temperatures. The annealed products showed the presence of acicular crystals of TiB₂, with those from 1 hour of milling being somewhat larger than those for longer milling times, where submicron particles were formed. This was attributed to the presence of a larger fraction of molten B₂O₃ compared to the longer-milled powders where TiBO₃ predominated.

[16] PRESSURE EFFECT ON CRYSTALLIZATION OF MECHANICALLY ALLOYED AMORPHOUS AL85FE15 ALLOY

Gu XJ. Ye F. Zhou F. Lu K. - Materials Science & Engineering A-Structural Materials Properties Microstructure & Processing. 278(1-2):61-65, 2000

The pressure effect on the crystallization of amorphous Al₈₅Fe₁₅ alloy prepared by means of ball-milling was investigated in a pressure range up to 1.4 GPa. It was found that the applied pressure enhances the nanoscale Fe-Al precipitation from amorphous matrix which does not occur at ambient pressure. The precipitation temperature of nanoscale Fe-Al from amorphous matrix decreases from about 380 to 200 degrees C when the applied pressure increases from 0.4 to 1.0 GPa. The high-pressure annealing of mechanically alloyed Al-based amorphous powders provides an effective approach to optimize the synthesis procedure for nanocrystalline/amorphous composite materials.

[15] THE EFFECT OF BALL MILLING DISPERSION ON THE OPTICAL PROPERTIES OF ORGANIC DYES TRAPPED IN SILICA FILMS BY THE SOL-GEL METHOD

Diaz-Flores LL. Perez-Bueno JJ. Vorobiev YV. Martinez JR. Ruiz F. Perez-Robles F. Gonzalez-Hernandez J. - Materials Letters. 42(1-2):25-32, 2000

Silicon dioxide coatings containing different types of dyes were prepared using the sol-gel method. It is found that the optical density of the coatings depends on both the dye concentration and on the degree of dye agglomeration. Coatings in which the dye forms aggregates show lower optical density than those in which the dye is better dispersed in the glass matrix. Dispersion of the dye in the starting material is achieved by a ball milling process. A simple model is used to explain the dependence of the optical density on the size of the dye aggregates.

[14] SYNTHESIS OF MAGNESIUM AND TITANIUM HYDRIDE VIA REACTIVE MECHANICAL ALLOYING - INFLUENCE OF 3D-METAL ADDITION ON MgH₂ SYNTHESIS

Bobet JL. Even C. Nakamura Y. Akiba E. Darriet B. - Journal of Alloys & Compounds. 298(1-2):279-284, 2000

TiH₂ and MgH₂ have been synthesized by Reactive Mechanical Alloying (CMA in H-2 or RMA) at room temperature starting from Ti and Mg powders. Ultrafine powder of TiH₂ was obtained after short milling time (<1 h for Ti powder and <5 h for Ti sponge). A complete conversion of alpha-Ti to TiH₂ was achieved, RMA of Mg powder only led to a partial conversion of Mg to MgH₂. However the ratio MgH₂/Mg can be improved by increasing the milling time or by adding a Sd-element. X-ray diffraction was applied successfully to determine the quantity of MgH₂ formed.

[13] STUDY OF A MECHANOCHEMICAL TRANSFORMATION IN IRON PYRITE

Eymery JP. Ylli F. - Journal of Alloys & Compounds. 298(1-2):306-309, 2000

The observation of a phase transformation from pyrite FeS₂ (Fe²⁺ in a low-spin state) to szomolnokite FeSO₄.H₂O (Fe²⁺ a high-spin state) by the mechanical action of ball-milling in air is reported. Fe-57 Mossbauer spectroscopy, X-ray diffraction and scanning electron microscopy were used to identify changes produced by mechanical activation. The pyrite structure can be sufficiently destabilized locally in the core of the powder particles, so that it may partly transform into szomolnokite during the milling process itself. After a long relaxation period in ambient air following sample grinding, the transformation process is shown to extend to the grain periphery without further mechanical activation.

[12] THE INFLUENCE OF A SURFACTANT ON THE CHARACTERISTICS OF THE IRON POWDERS OBTAINED BY MECHANICAL MILLING IN ORGANIC MEDIA

Lomayeva SF. Yelsukov EP. Konygin GN. Dorofeev GA. Povstugar VI. Mikhailova SS. Zagainov AV. Maratkanova AN. - Colloids & Surfaces A-Physicochemical & Engineering Aspects. 162(1-3):279-284, 2000

X-ray diffraction, Mossbauer spectroscopy, Auger spectroscopy and magnetic measurements have been used to investigate the effect of surfactants (oleic acid) on dispersion, structure, phase composition and magnetic behaviour of powders, obtained by milling of iron in a planetary ball mill in liquid hydrocarbon environment (heptane). The presence of a surfactant brings forward the dispersion increase in the powders, the change of the particle shapes and their magnetic characteristics. Namely, after 99 h treatment the 20-fold increase of coercitivity and 2-fold decrease of specific saturation magnetization was observed. The resulting powders have nanocrystalline structure (grain size approximate to 4 nm) and represent supersaturated solid solution of O and C in alpha-Fe with Fe₃C as impurities. The concentration of C and O, with heptane (C) and oleic acid (C,O) as their source, increases with milling time. The change of magnetic characteristics has been shown to depend on the content of C and O in the powders.

[11] GRAIN REFINEMENT OF STEEL BY OXIDIC SECOND PHASE PARTICLES

Gladman T. Fourlaris G. Talafi-Noghani M. - Materials Science & Technology. 15(12):1414-1424, 1999

Steels manufactured by a mechanical alloying and hot pressing route, to give a fine dispersion of alumina particles, have shown complete inhibition of grain growth after heating to 1350 degrees C for 30 min, and in the near fusion

line region of the heat affected zone of a bead on plate weldment. Comparison with theoretical predictions have shown that, with the 10 μ m radius of the as transformed austenite grains, the observed grain growth inhibition would be predicted. The efficacy of these fine dispersions can be attributed to the high stability of the alumina which results in extremely small levels of dissolution of alumina in austenite, and which also severely curbs the coarsening of the dispersed alumina particles. MST/4352.

[10] QUICKSILVER FROM CINNABAR: THE FIRST DOCUMENTED MECHANOCHEMICAL REACTION?

Takacs L. - JOM-Journal of the Minerals Metals & Materials Society. 52(1):12-13, 2000

Theophrastus' book *On Stones*, written in the fourth century B.C., is the earliest known work on minerals, their properties, and applications. The book is full of interesting information compiled in a clear, easy-to-read style. The excerpt examined in this article is especially important, as it represents the first known mechanochemical reaction, as well as the first description of any process for obtaining a pure metal from a compound.

[9] SYNTHESIS BY MECHANOCHEMICAL ACTIVATION AND STABILIZATION OF NEW FLUORITE-TYPE PHASES [SPANISH]

Begue P. Millan P. Castro A. - Boletín de la Sociedad Española de Cerámica y Vidrio. 38(6):558-562, 1999

During the synthesis by mechanochemical activation of the Aurivillius-like oxides the stabilization of oxygen deficient fluorite-type phases, never isolated before now, has been carried out. The corresponding Aurivillius oxides have been obtained about 350 degrees C below the necessary temperature for the synthesis by solid state reaction. Impedance spectroscopy measurements of Bi₃NbTiO₉ fluorite-type phase have shown an increase of the conductivity value of the Aurivillius phase, arising to about 10⁽⁻³⁾ ohm⁽⁻¹⁾.cm⁽⁻¹⁾ at 450 degrees C.

[8] MICROSTRUCTURE AND PIEZOELECTRICITY OF Bi₃TiNbO₉ CERAMICS FROM MECHANOCHEMICALLY ACTIVATED PRECURSORS [SPANISH]

Pardo L. Moure A. Castro A. Millan P. Alemany C. Jimenez B. - Boletín de la Sociedad Española de Cerámica y Vidrio. 38(6):563-567, 1999

Bi₃TiNbO₉ is one of the Aurivillius-type structure compounds, of general formula [Bi₂O₂][A_(n-1)B_(n)O_(3n+1)], made from pseudoperovskite (with n=2) layers alternating with Bi₂O₂ layers. It belongs to an ensemble of high transition temperature ferroelectrics that attracts nowadays a great deal of interest as piezoelectric materials for high temperature use (p.e. in non-destructive testing of materials by ultrasounds for siderurgy, nuclear plants or petrochemical industry). When prepared as thin films, they have interest as non-volatile computer memories (FERAM), due to their reduced fatigue, large polarization retention and low leakage currents. In solid state reaction and sintering, the lamellae-like growing habit, that resembles the layered crystalline structure, gives place to porous ceramics. Previous works used hot uniaxial pressing in order to obtain dense ceramics at low temperatures, avoiding changes in stoichiometry and exaggerated grain growth. But, such ceramics have anisotropic properties. In order to overcome these problems, Bi₃TiNbO₉ ceramics were obtained by cold-pressing of amorphous powder and sintering. The amorphous precursor was obtained by mechanochemical activation of a stoichiometric oxides mixture. The quantitative microstructural, ferro and piezoelectric characterization of the ceramics reveals that these ceramics have lower porosity, higher hardness, are better polarizable and show higher piezoelectric response than those prepared from solid state reaction powder.

[7] PHASE STABILITY AND DIELECTRIC PROPERTIES OF (1-X)PFW PLUS XPZN DERIVED FROM MECHANICAL ACTIVATION

Khim AS. Wang J. Xue JM. - Solid State Ionics. 127(3-4):285-293, 2000

Mechanical activation of mixed oxides of PbO, Fe₂O₃ and WO₃ did not lead to the formation of nanocrystalline Pb(Fe₂/3W₁/3)O₃ (PFW) of Perovskite structure, although the intermediate pyrochlore and PbWO₄ phases were realized. Nanocrystallites of Perovskite structure were observed to form in the mixed oxides of PbO, Fe₂O₃, WO₃, ZnO and Nb₂O₅ upon 20 h of mechanical activation. The amount of Perovskite phase thus formed increases with increasing content of PbO, ZnO and Nb₂O₅ equivalent to Pb(Zn₁/3Nb₂/3)O₃ (PZN) in composition, although Perovskite Pb(Zn₁/3Nb₂/3)O₃ cannot be synthesized by the conventional solid-state reaction. A nanocrystalline powder of predominant Perovskite phase was obtained by adding PbO, ZnO and Nb₂O₅ equivalent to 0.4 mole Pb(Zn₁/3Nb₂/3)O₃ into the mixed oxides of Pb(Fe₂/3W₁/3)O₃. However, the activation-derived Perovskite phase was unstable against thermal treatment at intermediate temperatures around 500 degrees C. Perovskite phase was redeveloped with a further increase in the sintering temperature in the range 700-800 degrees C, although the presence of PZN destabilizes the Perovskite structure in sintered PFW. 0.6PFW + 0.4PZN sintered at 850 degrees C demonstrates the behavior of a relaxer ferroelectric and exhibits a dielectric permittivity of similar to 5900 at 100 Hz and a Curie temperature of 27 degrees C.

[6] LEAD FREE SOLDER ALLOYS SN-ZN AND SN-SB PREPARED BY MECHANICAL ALLOYING

Huang ML. Wu CML. Lai JKL. Wang L. Wang FG. - Journal of Materials Science-Materials in Electronics. 11(1):57-65, 2000

The mechanical alloying (MA) processes of tin-zinc (Sn-Zn) and tin-antimony (Sn-Sb) were analyzed using an X-ray diffractometer, a differential scanning calorimeter (DSC) and a scanning electron microscope (SEM). The results showed that supersaturated solid solution and intermetallic compound were produced during the MA process. The size of powder particles could be controlled under the proper MA conditions and was reduced to 5 to 20 μ m. As a surfactant, proper addition of rosin allows MA to occur smoothly. However, it may also be a source of contamination of the metallic powder. It is considered that MA may be a technique analogous to casting to prepare solder alloys.

[5] WATER-BASED Si₃N₄ SUSPENSIONS: PART I. EFFECT OF PROCESSING ROUTES ON THE SURFACE CHEMISTRY AND PARTICLE INTERACTIONS

Galassi C. Bertoni F. Ardizzone S. Bianchi CL. - Journal of Materials Research. 15(1):155-163, 2000

Si₃N₄ powders manufactured by two different preparative routes were characterized for the solid-liquid interfacial reactivity and surface composition. Three mixing processes were tried to investigate the modifications of silicon nitride particle surface in aqueous suspensions. The surfaces of the starting powders and the dried mixed powders

were investigated by x-ray photoelectron spectroscopy to determine the nature and ratios of surface groups. Electroacoustic measurements show that no change occurs in the isoelectric point for the mixed Si₃N₄ powders while the milling/mixing process has a great influence on the zeta potential magnitude and particle size distribution.

[4] WATER-BASED Si₃N₄ SUSPENSIONS: PART II. EFFECT OF WET MIXING/MILLING PROCESSES ON THE ADDITION OF THE SINTERING AIDS

Galassi C. Bertoni F. Ardizzone S. Bianchi CL. - Journal of Materials Research. 15(1):164-169, 2000

Three mixing processes were used to introduce lanthanum oxide and yttrium oxide in silicon nitride suspensions. X-ray photoelectron spectroscopy (XPS) analysis was used to identify the surface composition and investigate the surface coverage by the added oxides. XPS results evidenced the protective effect against hydrolysis and oxidation of the coated layer. Electroacoustic measurements showed that the milling/mixing process and solids loading contents had a great influence on the isoelectric point (IEP) and on the dispersing degree for suspensions with sintering aids. With the change of solids load content and mixing energy, the IEP of mixed powders suspensions reflected a surface behavior dominated by the additives oxides. The attrition mixing and the ultrasonication resulted in the more efficient processing routes to distribute the sintering aids on the starting Si₃N₄ powders, especially at high solids volume fraction.

[3] RESISTIVE ANOMALIES AT NEAR 250 K IN HG-CA-CU-O AND FE-S SYSTEMS

Yom SS. Park JK. Kim GH. Kim HS. Lee JY. Choi ES. Park YW. - International Journal of Modern Physics B. 13(29-31):3755-3757, 1999

High pressure synthesized samples of nominal composition of Ca_{2-x}Hg_xCuO_y with $x = 0.10$ similar to 0.20 under reductive synthesis condition showed stable and reproducible resistivity onset transition at 225 similar to 254 K accompanied by rapid drop of thermoelectric power without accompanying magnetic susceptibility transition. Fe_{1-x}S ($x = 0$) by mechanical alloying method showed resistivity anomaly and thermal hysteresis at 150 similar to 180 K. These resistive anomalies may be phase transition of unknown origin rather than an indication of superconductivity.

[2] THE MICROSTRUCTURE AND MAGNETIC PROPERTIES OF NANOCRYSTALLINE Fe_{100-x}Si_x ALLOYS

Zhou TJ. Yu Z. Du YW. - Applied Physics a (Materials Science Processing). 70(1):75-78, 2000

Nanocrystalline Fe_{100-x}Si_x (x less than or equal to 25) alloys have been prepared by mechanical alloying. The crystallite size of the nanocrystalline FeSi alloys is about ten to fifteen nm. The individual crystallite separated by disordered grain boundaries has the structure of b.c.c. alpha-Fe. The Mossbauer patterns show that substitution of Si atoms for Fe ones is almost disordered in the nanocrystalline FeSi alloys. The saturation magnetization of the nanocrystalline FeSi alloys is slightly less than that of single-crystalline and polycrystalline FeSi alloys, whereas their coercive force and effective magnetocrystalline anisotropy constant are higher than those of the corresponding single-crystalline and polycrystalline FeSi alloys. The much higher coercive force and higher effective anisotropy of the nanocrystalline FeSi alloys may be related to the high strain in the grain boundaries.

[1] Al-27 NUCLEAR MAGNETIC RESONANCE ANALYSIS OF MECHANICAL ALLOYING PROCESS IN CU-AL MIXED POWDERS [CHINESE]

Li BQ. Nie C. - Acta Physica Sinica. 49(1):155-159, 2000

The variations of the Al-27 nuclear magnetic resonance (NMR) spectra of the aluminum-copper powder mixtures after different time of ball milling have been measured. By analyzing the Al-27 NMR spectra, the mechanical alloying (MA) process has been investigated at microscopic level. Al-27 Knight shifts in the series of Cu-Al samples decrease with increasing time of ball-milling. This means that the s component in the states of valence electron declines. The experimental results indicate that the true alloying reaction takes place during the MA process, and it is complete after about 90 hours of ball milling under our mechanical alloying conditions. Compared with the early results of Al-27 Knight shifts measured in the samples prepared by the traditional melt-alloying method, it has been concluded that the real Cu-Al alloys can be obtained by MA process, and they possess the same chemical short-ranged order as those with the same ingredients obtained by melting.

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