RESEAU FRANCAIS DE MECANOSYNTHESE

Lettre N°69

Décembre 2000

181 Groupes de Recherche

(dont 108 à l'étranger / 32 Pays)

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

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SOMMAIRE

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Le site web du RFM est :
http:://www.bls.fr/amatech
Rubrique Pages Sciences et Techniques pour l'Ingénieur (Rubrique Sciences)
vous y trouverez les anciennes lettres du RFM (accessible par Adobe Acrobat)
les statuts du RFM ainsi que les annonces concernant les JRFM'99 et quelques éléments mis a jour régulièrement concernant les derniers résultats dans ce domaine.

Corresp. : Eric.Gaffet@utbm.fr

JRFM'2001

21 et 22 Mai 2001 - Amiens - France

Thème 2001 :
Influence de la mécanosynthèse sur les propriétés physico - chimiques des matériaux

Contact :
Local Committee
Luc.Aymard@sc.u-picardie.fr
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Sophie.Voiron@sc.u-picardie.fr
ou pour le RFM :
Eric.Gaffet@utbm.fr

Mailing Address:
JRFM'2001
Laboratoire de Réactivité et Chimie des Solides
Faculté des Sciences
Université de Picardie Jules Verne
33 Rue de Saint Leu
80000 Amiens - France

JRFM'2001 (Programme Provisoire)

Conférences (liste provisoire)

Conférences Invitées

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

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

3) Fumio Saito
Title: Mechanochemical Dissociation of HBB
Authors: Qiwu Zhang, Hiroki Matsumoto, Fumio Saito and Michel Baron*
Speaker: Fumio Saito
Affiliations: IAMP, Tohoku University (Japan), *Ecole des Mines d'Albi (France)

Conférences orales

S. Galdeano*, M-H. Mathon*, L. Chaffron** et C-H. de Novion*
Etude des corrélations entre les conditions de broyage et la nanostructure dans le composé magnétorésistif Cu80(Fe0.3Co0.7)20
*Laboratoire Léon Brillouin (CEA/CNRS), CEN Saclay, 91191 Gif-sur-Yvette
** DTA/DECM/SRMP, CEN Saclay, 91191 Gif-sur-Yvette

Sylvie Begin-Colin, T. Girot, G. Le Caër, F. Radjai, X. Devaux
"Mécanismes et modélisation de transformations de phase induites par broyage dans TiO2"
Laboratoire de Science et Génie des Matériaux Métalliques
Ecole des Mines - 54 042 Nancy Cedex

J.M. Le Breton,G. Khélifati, L. Aymard et J. Teillet
"Broyage réactif sous hydrogène d'alliages Nd-Fe-B : destruction et recombinaison de la phase Nd2Fe14B"
Laboratoire de Magnetisme et Applications,Groupe de Physique des Matériaux
UMR CNRS 6634 Faculte des Sciences de Rouen
76821 Mont St Aignan Cedex

A.Fnidicki, C.Lemoine,J.Teillet
Effects de la contanination en oxygène et en azote gazeux sur les propriétés structurales et magnétiques des alliages Fe-Cr obtenus par mécanosynthèse.
Magnétisme et Applications - UMR 6634 CNRS
Université de Rouen - 76521 Mont Saint Aignan Cédex

B.Chevalier, J-L.Bobet et J.Etourneau
Influence du broyage énergétique sur les propriétés magnétiques d'intermétalliques à base de gadolinium et de manganèse B.Chevalier, J-L.Bobet et J.Etourneau.
ICMCB - CNRS [UPR 9048]
Groupe IV : Matériaux Magnétiques et Déterminations Structurales
Université Bordeaux I - Avenue du Dr.A.Schweitzer -33608 Pessac (France)

Sophie Soiron, Cyrille Lenain, Luc Aymard, F. Chevallier
Graphite broyé sous hydrogène ou sous oxygène: propriétés électrochimiques

Michel Baron, Alain Chamayou et Alexandre GIL
Centre Poudres et Procédés - Ecole des Mines d'Albi Carmaux
Campus Jarlard - Route de Teillet - 81013 ALBI CT Cedex 09

G. Saint -Ayes , L. Chaffron, G. LeCaër, G. Martin,JJViet, G. André
"Usure des roues de TGV : une approche de type alliage forcé"
SRMP/DECM / Bât. 520
CEA Saclay
91191 Gif-sur-Yvette Cedex, France

Raphaël Janot et Daniel Guérard
sur la synthèse de
nanoparticules de maghémite par broyage mécanique

E Gaffet
"Nanomateriaux : Aspects Technico - Economiques"
CNRS - Groupe "Nanomateriaux"
Universite de Technologie de Belfort Montbeliard (UTBM)

Posters
Raphaël JANOT et Daniel Guérard
La préparation, par mécanosynthèse d'hydrures de rubidium et de césium

Fritsch Forum Part VI

Information from Fritsch (A. Kohler)

The subject of the sixth forum part scheduled for September 14/15th, 2000, will be "high-energy fine grinding". Research and Development demand general-purpose grinding processes which simultaneously exactly define the required energy and the type of stress. This is the only way that reliable results can be achieved when determining activation energies or the mechanical alloying. It must be possible to reproducibly adjust all of the grinding parameters affecting the grinding results.

Participants from research, development and industry will report on demands and novel technological solutions in developing innovative milling technologies. One of the highlights of the event will be FRITSCH's new Vario-planetary mill "pulverisette 4". This planetary ball mill can simulate ball mills of conventional construction, precisely copy the types of stresses that occur there, and thus reproduce or optimise grinding processes. Due to the great flexibility when selecting the grinding parameters, it is possible to produce results that are unattainable with other ball mills. It is the ideal mill for mechanical activation and alloying. The main applications are in the area of material research and naturally wherever a powerful, innovative laboratory planetary mill is needed.

An extensive report has been written about this event which details and makes readily available the relevant parts of the lectures and the extensive results of the discussions. Anyone interested can request a copy of the complete report for this forum part VI event on the topic "high-energy fine grinding". Please contact Andrea Köhler, FRITSCH GMBH, Industriestrasse 8, D-55743 Idar-Oberstein, (Phone: 0049/6784/7046, E-Mail: koehler@fritsch.de)

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Technical Announcement

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M.B.N.srl

via Roma, 4

I-31020 San Vendemiano (TV) - Italie

• 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

Contact : E-mail: info@mbn.it

Web site: http://www.mbn.it

Phone Number : +39 0422 718956

Fax Number : +39 0422 718964

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VARIO-PLANETARY MILL "pulverisette 4"

The "pulverisette 4" vario-planetary mill is capable of emulating ball mills of conventional design, precisely simulating the types of stress entailed and thus reproducing or optimising grinding processes. Due to the high flexibility available for selecting the grinding parameters, it is possible to achieve results unattainable with any other ball mills.

This is the ideal mill for mechanical activation and alloying. The main applications are in the field of materials research and, of course, wherever a powerful, innovative planetary mill is required.

When particles < 10 mm are fed in, a final fineness up to 0.1 µm can be achieved. The useful capacity is between 2 x 30 ml in the case of 80 ml grinding bowls and 2 x 125 ml when 250 ml grinding bowl are used.

Method of operation:

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

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

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

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

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

Features of performance:

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

• Programming of the grinding parameters by PC software as desired

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

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

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

• Emulation of various ball mills

• Variably adjustable pressure on sample (friction and/or impact)

• Final fineness << 1 µm

• Simultaneous grinding in up to 4 small or 2 large grinding bowls

• Quick, secure fastening of the grinding bowls

• Ease of cleaning

contact:
Fritsch GmbH (Andrea Köhler)
Manufacturers of Laboratory Instruments
Industriestrasse 8
D-55743 Idar-Oberstein
Phone: ++49/ 67 84/70-46
Fax: ++49/ 67 84/70-11
E-Mail: info@fritsch.de
Internet: http://www.fritsch.de

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Annonce de congres et / Ou Ecoles
Congress and School Announcements

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International Conference on Trends in Mechanical Alloying Science, Technology and Applications (TMA-2001)
Janpur, India Feb. 21-23, 2001.
Secretariat of Int. Conf. TMA-2001
Organizer : Dr. P. R. Soni
Department of Metallurgical Engineering,
Malaviya Regional Engineering College
Jaipur-302017, India
Tel : +91-0141-702042
Fax : +91-0141-702954
E-mail : psmt@arya.recjai.ernet.in
Contact Persons : Dr. P. R. Soni - Prof. T. V. Rajan

Particles 2001
24-27 February 2001
Rosen Center Hotel, Orlando, FL
http://www.nanoparticles.org

Journées Annuelles 2001 du GFC
Ecole des Mines de St Etienne
22 / 22 Mars 2001
Thèmes prévus :

NOUVEAU

Corrosion - Filtration - Tribologie - Capteurs
Contacts : B. Guilhot et F. Thévenot
Ecole Nationale Supérieure des Mines de St Etienne
158 Cours Fauriel
42023 - St Etienne Cedex
E_Mail : Thevenot@emse.fr ou BGuilhot@emse.fr
Rmq : Propositions de communications avant le 15 Janvier 2001

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

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

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

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

ISMANAM2001
University of Michigan, Ann Arbor, Michigan, USA
on 24-30 June 2001.
Abstract deadline is March 1st, 2001.
Abstracts of 200-400 words should be submitted by e-mail to
E_Mail : ISMANAM-2001@umich.edu
Web site : http://www-ners.engin.umich.edu/ISMANAM2001.

COLLOQUE SUR LES INNOVATIONS
DANS LES MATERIAUX FRITTES
Poitiers-Futuroscope

3-4-5 juillet 2001
consulter le site www.sf2m.asso.fr (rubriques sommaires puis conférences)

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SOUTENANCES DE THESE
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T. Ziller

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

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

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

Les évolutions, au cours de la mécanosynthèse, de mélanges de poudres Fe-X (X=Cr,Mn,V,Mo) ont été caractérisées de l'échelle de la particule de poudre jusqu'à l'échelle atomique par granulométrie laser, MEB, microsonde, diffraction des rayons X et des neutrons, spectrométrie Mössbauer et mesures d'aimantation et de susceptibilité. Nous avons mis en évidence une combinaison des éléments plus rapide lorsque l'évolution thermodynamique du système conduit au mélange (Fe0.28Mn0.72) que lorsqu'elle conduit à une démixtion (Fe0.30Cr0.70). Dans nos conditions de broyage, l'état stationnaire du mélange Fe0.30Cr0.70 n'est pas une solution solide homogène mais est caractérisé par des fluctuations de composition à une échelle de quelques nanomètres. Ces différents résultats ne peuvent s'expliquer que par une compétition entre un mécanisme de mélange forcé par le broyage et un processus thermique de démixtion.

Une phase amorphe se forme, lors de la mécanosynthèses de mélanges de poudres Fe0.30Mo0.70 et Fe0.66Mo0.34, aux interfaces entre les lamelles de Fe et Mo. Cette amorphisation est probablement due à la fois à l'asymétrie des coefficients de diffusion des deux espèces et à une déstabilisation du réseau cristallin induite par le mélange forcé des éléments au-delà d'une certaine limite de concentration.

La mise en ordre (A2B2), par recuit, d'alliages Fe-V élaborés par mécanosynthèse, a été étudiée par diffraction des neutrons et spectrométrie Mössbauer. À 450°C, le degré d'ordre d'un alliage Fe0.53V0.47 se stabilise à une valeur anormalement basse. Nous avons attribué ces caractéristiques à la subsistance de débris de parois d'antiphase ne pouvant s'éliminer que lorsque la température est assez élevée pour permettre une migration des lacunes à longue distance. Nous avons également confirmé l'existence d'un domaine biphasé A2+B2, prévu par la théorie, dans un alliage Fe0.37V0.63 recuit à 450°C.

The evolutions of Fe-X (X=Cr,Mn,V,Mo) elemental powders mixtures during mechanical alloying have been characterized from the scale of the powder particle down to the atomic scale by laser granulometry, scanning electron microscopy, microprobe analysis, X-ray and neutron diffraction, Mössbauer spectroscopy and magnetic and susceptibility measurements. When the thermodynamic evolution of the system leads to mixing (Fe0.28Mn0.72), the combination of the elements is faster than when it leads to unmixing (Fe0.30Cr0.70). In our milling conditions, the stationary state of $Fe_{0.30}Cr_{0.70}$ powders mixture is not a homogeneous solid solution but presents nanosized composition fluctuations. These results can only be explained in the light of a competition between a driven mixing mechanism and a thermal unmixing process.

During mechanical alloying of $Fe_{0.30}Mo_{0.70}$ and $Fe_{0.66}Mo_{0.34}$ powder mixtures, an amorphous phase is formed at the interfaces between the Fe and Mo layers. This amorphisation seems to be due to the asymmetry of the diffusion coefficients of Fe and Mo added to a destabilization of the crystalline lattice linked to the driven mixing of the elements beyond a critical concentration.

The ordering (A2B2) under annealing of Fe-V alloys synthesized by mechanical alloying has been studied by neutron diffraction and Mössbauer spectroscopy. At 450°C, the order parameter of Fe0.53V0.47 stabilizes at an unusual low value that can be attributed to residual fragments of antiphase boundaries. Only high enough temperatures can lead to the elimination of these defects thanks to long range migration of vacancies. An A2+B2 two-phase domain, predicted by the theory, has been observed in Fe0.37V0.63 alloy annealed at 450°C.

V. Gauthier

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

Influence du mode de préparation sur le processusd'oxydation

18 Décembre 2000

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

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A. C. Sekkal

Etude des Transformations Tribologiques de Surfaces

ou TTS induites par impacts à énergie controlée

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

Corresp. : Eric.Gaffet@utbm.fr

Sous l'effet de sollicitations cycliques dans le domaine plastique, des matériaux mÈtalliques (titane, alliage de titane†: TiAl6V, acier faiblement allié nitruré: 32 CrMoV13) présentent des transformations microstructurales singulières conventionnellement dÈsignées par la locution "Transformations Tribologiques de Surface ou TTS". Le produit ainsi formé, quelque soit le matériau initial (dans le cadre de notre étude) se caractérise par†: une dureté très élevée, une structure nanocristalline (voisine de 100 nm de taille moyenne), une grande densité de dislocations, la présence díune solution solide sursaturÈe du fait de la mise en solution des différents éléments qui constituent le matériau, et l'absence de texture. Une forte analogie peut être établie avec le produit élaboré par fretting en glissement total mais aussi dans le cadre de certaines approches en mécanosynthèse ou lors des transformations induites par cisaillement adiabatique.
A partir d'un test que nous avons mis au point en instrumentant et qualifiant un appareillage permettant de réaliser díune manière fiable et reproductible des impacts à énergie controlée (quelques mJ) donc à des pressions variables et à des vitesses de l'ordre du m/s, nous avons élaboré et caractérisé (par microscopies optique, MEB, MET, traceur radioactif, nanoindentation, diffraction X, Ö) la TTS dans différentes configurations.
En nous appuyant sur différentes modélisations (théories d'ARCHARD, JOHNSON-COOKES, SCHWARZ, recristallisation dynamique) mises en œuvre pour interpréter les transformations induites dans les cas précédemment cités, nous avons mis en Èvidence le rôle complémentaire des effets mécanique et thermique et tenté de dégager les hypothèses les plus probables.

N. LORRAIN

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

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

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J.Ph. BRAGANTI

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

20 octobre 2000 – Université Henri Poincaré – Nancy I – Vandoeuvre lès Nancy

Jury : C. Bergman (Rapp.), J.P. Bros (Rapp.), J.M. Moreau, S. Colin-Bégin, J.C. Gachon, F.A. Kuhnast (Dir)

Le travail de cette thèse est consacré à l'étude de la cristallisation d'alliages amorphes binaires ou ternaires Al-Ni-Zr préparés par broyage mécanique. Ces alliages amorphes sont caractérisés par leur état thermodynamique hors équilibre. Pour envisager des applications, il est nécessaire de connaître leur évolution vers l'état d'équilibre final.

Il est possible d'aborder deux aspects de la cristallisation, cinétique et chemin de cristallisation, grâce aux techniques expérimentales suivantes :
- la microcalorimétrie différentielle à balayage très adaptée à l'étude de la cinétique de cristallisation,
- la diffraction X classique et la diffraction X en temps réel pour l'étude des chemins de cristallisation.

M. Nakhl

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

16 Octobre 2000 - Université de Bordeaux I - Bordeaux

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

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Ch. Gras

Réactivité et Thermodynamique dans le procédé MASHS
(Mechanically Activated Self - Propagating High - Temperature Synthesis) :
Application aux systèmes Mo / Si et Fe / Si

6 Septembre 2000 - Univ. de Bourgogne - Dijon

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

M. Zouggar

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

4 Septembre 2000 - LMP - Poitiers

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

C. Goujon

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

25 Mai 2000 - ENSMSE

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

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J. Joardar

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

Avril 2000

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

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

Christine Barbeau

(Laboratoire de Métallurgie Physique - Futuroscope)

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

13 mars 2000

Thèse de Doctorat de l'Université de Poitiers

Jury: A. TRAVERSE, Directeur de Recherche, LURE Orsay, Rapporteur - F. NARDOU, Professeur, Université de Limoges, Rapporteur, D. VREL, Chargé de Recherche, Université de Villetaneuse - Examinateur, M.F. BEAUFORT - Chargé de Recherche CNRS, LMP Poitiers - Examinateur, M. GROSBRAS - Chargé de Recherche CNRS, LMP Poitiers, Examinateur - J. MIMAULT, Professeur, Université de Poitiers, Examinateur et Directeur de Thèse

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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 NOGUES, Chargé de Recherche, Université de Versailles (Rapporteur), Jean-Franÿois 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 GRENèCHE, 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)

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Cooperative Research on Related Areas
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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.

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

ALLEMAGNE (11/2000) Ph D or Post Doc Position
We are looking for a PhD candidate / Postdoc to start as soon as possible in the framework of an European RTN network on bulk metallic glasses and nanostructured materials.
Dr. Jürgen Eckert
IFW Dresden - Institut für Metallische Werkstoffe
Postfach 27 00 16 - D-01171 Dresden -Germany
>Tel.: +49 (351) 4659-602/-324
>Fax: +49 (351) 4659-541
>E-mail: j.eckert@ifw-dresden.de
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ESPAGNE (25/09/2000) POSTDOCTORAL POSITION (From M.D. Baro)
Universitat AutÚnoma de Barcelona
The Group de Fisica de Materials II of the Physics Department of the UAB announces the availability of a 18 months full-time Postdoctoral Research position. Applicants should hold a PhD degree in Materials Science, Physics or in a related field. The position requires:
Knowledge of glasses, metastable and nanocrystalline materials.
Fundamental understanding of the nucleation and crystal growth theories.
Knowledge of calorimetry and thermostability.
Experience in electron, optical and x-ray based characterisation techniques and practices.
Computer literacy.
Citizenship of EU (except Spain) or Associated states.
Under 35 years old.
Proficient level of English
The position begins with effect from January 2001. The research programme includes a close co-operation with other partners of the Project. Applicants should submit a CV, and a statement describing your interest in the position with two references to:
Professor M.D. Baro,
Dept. Physics, Edifici Cc,
08193 Bellaterra,
Barcelona, Spain;
Tel: 34 93 5811657.
Electronic applications can be sent to dolors.baro@uab.es"
****
Angleterre (21/09/2000) - From Paul Warren (paul.warren@materials.oxford.ac.uk)
Job vacancies in a Research Training Network.
Research Training Network on Manufacture and Characterisation of Nanostructured Al alloys
Pre-doctoral/post-doctoral researchers required at 9 institutions across Europe.
The research positions will involve aspects of : materials processing by gas atomization, rapid solidification and mechanical alloying, followed by compaction; microstructural and microchemical characterisation by XRD, DSC, TEM, STEM, APFIM ; thermodynamic / kinetic modelling and molecular dynamic simulation ; mechanical property evaluation by tensile testing, fatigue testing and high strain rate impact testing.
See Network Homepage http://www.materials.ox.ac.uk/nano-al/ for more details.
****
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. Placment 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 :

Bibliographie Récente

Livres ou "Special Issues"

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

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

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

Nanocrystalline TiC by Mechanical Alloying Method - Properties of Mechanically Solid State Reacted TiC Powders - Other Carbides Produced by Mechanical Alloying - References 124 - Mechanically Induced Solid-Gas Reaction - Introduction - Fabrication of Nanocrystalline TiN by Reactive Ball milling - Properties of Reacted Ball Milled TiN Powders - Mechanism of Fabrication - Other Nitrides Produced by RBM - Fabrication of Nanocrystalline Solid Solution NiTiH by Reactive Ball Milling - References 157 - Mechanically Induced Solid-State Reduction - Introduction - Reduction of Cu2O with Ti by Room Temperature Rod Milling - Properties of Rod-Milled Powders - Mechanism of MSSR - Fabrication of Nanocrystalline WC and Nanocomposite WC-MgO Refractory Materials by MSSR and Methods - References 189 - Mechanically Induced Solid-State Amorphi
Mechanical Solid State Amorphization of Fe50W50 Binary System - Special Systems and Applications - Amorphous Austenitic Stainless Steel 254 - Fabrication of amorphous Fe52Nb48 Special Steel 257 - Fe-Zr-B 259 - Difference between Mechanical Alloying and Mechanical Disordering in the Amorphization Reaction of Al 50Ta50 in a Rod Mill - Mechanically Induced Cyclic Crystalline-Amorphous Transformations During Mechanical Alloying - References 295 -

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

(3/02/2000)
Two new books on mechanical alloying are now available from Cambridge International Science Publishing (infos fournies par Anne Porter - Publishing Manager - Cambridge International Science Publishing http://www.demon.co.uk/cambsci/homepage.htm)
1. MECHANICAL ALLOYING - FUNDAMENTALS AND APPLICATIONS
http://www.demon.co.uk/cambsci/book52.htm Contents
Introduction (history, benefits of mechanical alloying); Mechanical alloying (alloying mills, mills in practice, improved mills, the process, parameters);
Variations of mechanical alloying (reaction milling, cryomilling, repeated rolling, double mechanical alloying, repeated forging); Process control agents in mechanical alloying; Mechanical alloying mechanisms (ductile-ductile system, ductile-brittle system, brittle-brittle system, metastable phase formation, amorphisation, nanocrystallization, extension of solid solubility, activation of solid state chemical interaction);
Energy transfer and energy maps;
Consolidation of mechanically alloyed powders (consolidation techniques, thermomechanical treatment); Mechanical properties of mechanically alloyed materials (tensile properties, fracture, creep, stress corrosion cracking susceptibility);
Modelling mechanical alloying (mechanistic models, deformation, coalescence and fragmentation, evolution of particle size, milling time, powder heating, powder cooling, atomistic model, thermodynamic and kinetic model) Joining of mechanically alloyed materials; Rapid solidification and mechanical alloying; Applications (nickel-based superalloys, Al-based materials, supersaturated solutions, magnetic materials, mechanically alloyed powders for spray coatings, superplasticity, tribological materials, composites, amorphous solids, nanocrystalline materials, solid-state chemical reactions, etc). ISBN 1898326568, 160 pages 234 **156 mm, cased,** £45.00, 1999

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DISPERSION STRENGTHENED ALUMINIUM PREPARED BY MECHANICAL ALLOYING, by M Besterci
http://www.demon.co.uk/cambsci/book51.htm 1. Characteristics of dispersion-strengthened systems 2. Mechanical alloying (kinetics and mechanism of preparation of the Al-C system by mechanical alloying; compaction of powders and heat treatment of compacts;
3. Microstructure and quantitative evaluation of parameters of dispersion-strengthened materials (definition and properties of interparticle distance; experimental possibilities of determination of structural objects; models of heterogeneous structures and their evaluation; simulation of model structures; analysis of the spatial distribution of particles in the Al-Al4C3 material)
4. Static and dynamic mechanical properties (mechanical properties at elevated temperatures; mechanical properties at 20 °C; effect of interface on the mechanical properties; superplastic properties of the system; thermal stability of the system; creep characteristics; creep-fatigue characteristics)
References - ISBN 189832655X, 90 pages, 234 **156 mm, soft laminated cover,** £25.00, 1999

"Mechanical Alloying : Fundamentals and Applications"

Prof. P.R. Soni (1999) - Cambridge International Science Publishing

web site : http://www.demon.co.uk/cambsi/book52.htm

"Non Equilibrium Processing of Materials"

R.W. Cahn - Elsevier Science - Volume 2 in the Pergamon Materials Series

A large number of technical papers have been published in reviews, monographs and conference proceedings, but have almost always been devoted to a single processing technique. This book, however, covers all the non equlibrium processing methods and their effects in a single volume.

web site : 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 workd and these materials have now gained a position of great importance in basic science and engineering materials technology. Bulk amorphous alloys based upon the Zr - Al - Ni - Cu, Zr (Tin,Nb) - Al - Ni - Cu and Zr - Ti - Ni - Cu - Be systems have already achieved wide commercial success as components of various technical accessories ranging from sporting goods to optical instruments.
Here is a state of the art reviews on this new group of materials, 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 Besterci, Institute of Materials Research, Slovak Academy of Sciences, Kosice
In the book, the author describes the theoretical and technological fundamentals of mechanical alloying the Al-C system. Special attention is given to material characteristics, the kinetics and mechanism of mechanical alloying, methods of mixture compaction and heat treatment of compacted parts. Models of dispersoid spatial arrangement, dispersoid evaluation and optimisation and experimental possibilities are discussed. The interpretation of the static and dynamic mechanical properties, especially strength and ductility properties at 20 °C, mechanical properties at elevated temperatures are discussed, with emphasis on the effect of interface, superplasticity, creep and creep-fatigue characteristics. Content
Introduction
1. Characteristics of dispersion-strengthened systems
2. Mechanical alloying (kinetics and mechanism of preparation of the Al-C system by mechanical alloying; compaction of powders and heat treatment of compacts;
3. Microstructure and quantitative evaluation of parameters of dispersion-strengthened materials (definition and properties of interparticle distance; experimental possibilities of determination of structural objects; models of heterogeneous structures and their evaluation; simulation of model structures; analysis of the spatial distribution of particles in the Al-Al4C3 material) 4. Static and dynamic mechanical properties (mechanical properties at elevated temperatures; mechanical properties at 20°C; effect of interface on the mechanical properties; superplastic
properties of the system; thermal stability of the system; creep characteristics; creep-fatigue characteristics)
Index : ISBN 189832655X, 80 pages, 234 **156 mm, soft laminated cover,** £22.00, January 1999
Cambridge International Science Publishing 7 Meadow Walk, Great Abington, Cambridge CB1 6AZ, England Fax +44 1223 894539; Tel +44 1223 893295 Email: cisp@cisp.demon.co.uk
http://www.demon.co.uk/cambsci/homepage.htm

"Mechanical Alloying"
Auteurs : Li Lü & Man On Lai(National University of Singapore)
Kluwer Academic Publishers
Contents : Preface - Introduction to Mechanical Alloying - Experimental Set - Up - The Mechanical Alloying Process

- Formation of New Materials - Characterization of Powders - Densification - Mechanical Properties - Mechanisms of Mechanical Alloying - Modeling of Mechanical Alloying - Index

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"Surface-Controlled Nanoscale Materials for High-Added-Value Applications"
Editors: Kenneth E. Gonsalves, Marie-Isabelle Baraton, Rajiv Singh, Heinrich Hofmann, Jerry X. Chen, and Joseph A. Akkara.
Materials Research Society, Symposium Proceedings Volume 501, 1998
MRS, Warrendale, Pennsylvania, USA (website: http://www.mrs.org/)

"Nanomatériaux"
Auteurs : E. Gaffet, S. Begin - Colin, O. Tillement
Editeur : Innovation 128 - 24 Rue du Quatre Septembre - 75002 Paris - France - Fax : 33 1 42 65 47 76
Les dernières années ont vu apparaître dans le monde des matériaux avancés le préfixe "nano" (nanostructuré, nanocristallins, nanophase ou nanométrique) ; les conférences et les forums sur Internet se multiplient où s'échangent des informations sur les avancées scientifiques et technologiques dans ce domaine des matériaux nanostructurés qui se distinguent des matériaux polycristallins conventionnels par la dimension des cristallites les composant ou par la dimension des hétérostructures présentes : ces dimensions sont de quelques dizaines d'angströms, voire de quelques nanomètres. A ces dimensions, les propriétés des matériaux changent radicalement.
Au début des années 90, les japonais ont été les premiers a lancé d'ambitieux programmes de R & D puisque le MITI a consacré aux nanomatériaux près de 200 millions de dollars pour la période 1990 - 2000 et que la Science & Technology Foundation a investi presque la même somme pour co - financer des projets de laboratoires publics et privés. Les Etats Unis puis les pays européens ont investi plus tardivement mais déjà ont obtenu des résultats prometteurs (••••••) Certaines applications existent déjà au niveau international, quelque 400 sociétés se partagent aujourd'hui un marché voisin de 1 milliard de dollars mais qui devrait tripler, voire quintupler à l'horizon 2001.(••••••)
(•••) Pour aider les industriels concernés à imaginer les applications qu'ils pourraient s'approprier et identifier les acteurs internationaux, la présente étude dresse un état de l'art complet des nanomatériaux en décrivant leurs procédés d'élaboration actuels ou envisagés et en détaillant leurs différentes propriétés physico - chimiques et les géométries que l'on peut obtenir.
Enfin l'étude permet de cerner les applications actuelles et potentielles•••

CHEMISTRY FOR SUSTAINABLE DEVELOPMENT
Vol. 6, No. 2-3, MARCH-JUNE 1998
Proceedings of 2d International Conference on Mechanochemistry
(INCOME-2), which was held in Novosibirsk in 1997.
Contact : Prof. • N.Z. Lyakhov, Inst. Sol. State Chem.- Russian Acad Sci. - Kutaleladze, 18 - Novosibirsk - 630128 Russia - The Proceedings will be available by the price 80 USD.

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

BIBLIOGRAPHY ON MECHANICAL ALLOYING AND MILLING
Suryanarayana (Inst for Materials and Advanced Processes, University of Idaho, USA)
The present bibliography covers information on mechanical alloying and milling of materials starting from 1970 (when it was recognized that MA has become a commercial/viable material processing technique instead of just a grinding method) to 1996. All the available references will be presented in a chronological fashion. Under each year, (•••••)
Please send your order to: Book Department - Cambridge International Science Publishing 7 Meadow Walk, Great Abington, Cambridge CB1 6AZ, England Fax: +44 1223 894 539; tel +44 1223 893295, email: orders@cisp.demon.co.uk / Cambridge International Science Publishing http://www.demon.co.uk/cambsci/homepage.htm

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

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

[34] Effect of magnetic field on phase transformations in MnAs and Ni2MnGa compounds
Chernenko V. L'vov V. Cesari E. McCormick P. - Materials Transactions Jim. 41(8):928-932, 2000
The results of magnetic measurements in MnAs prepared by ball-milling and single crystalline ferromagnetic Ni2MnGa specimens exhibiting magnetostructural and martensitic transformations respectively are presented. Some details of the transformation behaviour and giant magnetoelastic response of these compounds are explained within the Bean-Rodbell model and Landau approach.

[33] Application of dry grinding to reduction in transformation temperature of aluminum hydroxides
Kano J. Saeki S. Saito F. Tanjo M. Yamazaki S. - International Journal of Mineral Processing. 60(2):91-100, 2000
Dry grinding of gibbsite (alpha-Al(OH)(3)) and pseudo (p)-boehmite (gamma-AlO(OH)) powder samples separately, with and without fine a-alumina powder as a seed, was conducted using a planetary ball mill to investigate effects of grinding and addition of the seed on their transformation temperatures to or-phase during heating. The transformation temperatures of both samples reduced to below 1000 degrees C with increasing grinding time as well as the amount of seed. The transformation temperatures depend on the grinding time and the amount of seed, and the minimum temperatures are about 910 degrees C for gibbsite and about 950 degrees C for p-boehmite when they are ground for more than 60 min with an equivalent amount of the seed powder. Combination of grinding with addition of the seed would be an effective operation for the reduction in the transformation temperature of bath compounds to a-phase.

[32] Role of disclinations and nanocrystalline state in the formation of quasicrystalline phases on mechanical alloying of Cu-Fe powders
Subramanian R. Ramakrishnan SS. Shankar P. - Journal of Materials Science & Technology. 16(5):499-503, 2000
Elemental powders of Cu and Fe were ball milled for various time durations up to 100 h. The various stages of forced alloying by ball milling, leading to instability of elemental crystalline phases and formation of quasicrystalline phases were monitored using X-ray diffraction. Diffusion of Fe into the Cu matrix is proposed as the cause which triggers the instability of crystalline phases and leads to the formation of quasicrystalline phases after 10 h of milling. Milling for 100 h resulted in two different quasicrystalline phases with different lattice constants. Role of the nanocrystalline microstructure as an important criterion for the destabilisation of crystalline phases is explained. It is suggested that the formation of nanocrystalline microstructure and their subsequent transformation into quasicrystalline phases may be associated with a continuous increase in the disclination content of the system, which had formed as a result of continued milling and mechanical deformation.

[31] The formation of Cu2S from the elements I. Copper used in form of powders
Blachnik R. Muller A. - Thermochimica Acta. 361(1-2):31-52, 2000
The synthesis of Cu2S from copper and sulfur from various sources has been studied in the DTA from 25 to 600 degrees C. The educts and products were characterised by X-ray diffraction. Mixtures of copper and sulfur were investigated in form of powders and of pellets. In the beginning of the reaction sulfides with high sulfur content are formed. In powders the main reaction takes place immediately after melting of sulfur whereas in pellets the larger exothermic effects appear at higher temperatures. In most samples the formation of Cu2S is completed above 450 degrees C. The difference in behaviour of powders and pellets is mainly based on the sample-crucible geometry, hut also on different educt concentrations. Similar investigations were performed by mechanical alloying in a planetary ball mill with total milling times in the range 1-120 min. CuS, Cu1.8S, Cu1.95S, Cu1.96S, and alpha-Cu2S are formed in this order with increasing milling times. Almost no overlap in their formation was observed, because the brittle copper sulfides are removed by milling from the surface of the particles. The formation of further products is thus not hindered. Particle size, pretreatment and source of copper but not of sulfur influences significantly the reaction. The behaviour of copper powder of various manufacturers differed, despite the same pretreatment and particle size ranges, due to differences in particle size distribution, particle shape, grain size or oxygen content. Ageing experiments revealed that less metastable products are formed than in milling experiments or in quenched samples. Ageing in inert atmosphere produces CuS and does not exceed this stage even after several months. Different intermediate products were formed with a higher rate from the beginning, when the samples were stored in vacuum after short irradiation with intense light.

[30] Solid-phase synthesis of europium and terbium complexes with nitrogen-containing heterocyclic compounds under mechanical activation
Kalinovskaya IV. Karasev VE. - Russian Journal of Inorganic Chemistry. 45(9):1360-1362, 2000
The interaction of europium(III) and terbium(III) nitrates with nitrogen-containing heterocyclic compounds under mechanical activation was shown to lead to the formation of compounds with the Ln(NO3)(3) . 2D composition, where Ln is Eu or Tb; D is 2,2-dipyridyl, 1,10-phenanthroline, or 1,3-diphenylguanidine. The influence of mechanical activation conditions and additives on the course of synthesis and the product yield was studied. The compounds were characterized by the methods of chemical elemental analysis and IR and luminescence spectroscopy.

[29] X-ray diffraction and Mossbauer characterization of Raney Fe-Ni catalysts
Zeifert BH. Salmones J. Hernandez JA. Reynoso R. Nava N. Reguera E. Cabanas-Moreno JG. Aguilar-Rios G. - Journal of Radioanalytical & Nuclear Chemistry. 245(3):637-639, 2000
Raney type catalysts were prepared by means of a two step procedure: (1) Mechanical alloying of the metals and, (2) alkaline aluminum leaching. Mechanical alloying is a novel alternative related to the synthesis of skeletal Ni catalysts. X-ray diffraction, and Mossbauer spectroscopies were performed for catalysts characterization. Binary Al-Ni and ternary Al-Ni-Fe alloys were produced by mechanical alloying from pure metallic powders; in particular, the intermetallic beta-(AlNi) phase was formed with a fine microstructure as a non-equilibrium phase; then, aluminum

was selectively removed. After aluminum leaching the beta-(AlNi) phase was transformed into the more stable nickel fee structure.

[28] A study on barium ferrite particles prepared by chemical coprecipitation

Ng WK. Ding J. Chow YY. Wang S. Shi Y. - Journal of Materials Research. 15(10):2151-2156, 2000

Chemical coprecipitation was employed to prepare fine particles of barium ferrite with high coercivity (450 kA/m). Magnetic properties of the bonded barium ferrite magnet were measured at different temperatures. The results were found to be fairly close to the theoretical values based on the Stoner-Wohlfarth model. Mechanical milling was utilized to prepare ultrafine dispersed barium ferrite particles. NaF was introduced as a dispersing agent during milling and subsequent heat treatment. The dispersed particles were compacted and then subjected to die upsetting at room temperature. A weak anisotropy in the coercivity and remanence was found in the directions parallel and perpendicular to the compaction direction.

[27] Mechanical activation synthesis and dielectric properties of 0.48PFN-0.36PFW-0.16PZN from mixed oxides

Khim AS. Wang J. Xue JM. - Journal of Alloys & Compounds. 311(2):181-187, 2000

Nanocrystalline 0.48PFN-0.36PFW-0.16PZN phase of perovskite structure was successfully prepared via mechanical activation of mixed oxides of PbO, Fe2O3, WO3, Nb2O5 and ZnO for more than 15 h at room temperature. The powder derived from 20 h of mechanical activation exhibits a particle size in the range of 10-20 nm. It undergoes decomposition upon heat treatment to pyrochlore phase before a single perovskite phase was developed at the sintering temperature of 820 degrees C for 45 min. The sintered ceramic exhibits a density of similar to 98% theoretical density and a maximum dielectric permittivity of similar to 9357 at the Curie temperature of similar to 27 degrees C measured at a frequency of 100 Hz.

[26] Electrochemical characteristics of amorphous Mg0.9M0.1Ni (M=Ni, Ti, Zr, Co and Si) ternary alloys prepared by mechanical alloying

Ye H. Lei YQ. Chen LS. Zhang H. - Journal of Alloys & Compounds. 311(2):194-199, 2000

Mg0.9M0.1Ni (M=Ni, Ti, Zr, Co or Si) ternary alloys were prepared by mechanical alloying (MA). The XRD result showed that all ternary alloys were of amorphous structure, with a trace of substitution elements, except for Co. Electrochemical characteristics of all ternary alloys were studied which were compared to MA amorphous MgNi alloy. Experimental results showed that the ternary alloys had a large discharge capacity at room temperature but lower than that of the MA MgNi alloy. Partially substituting Mg with Ni, Ti, Co, Si could lead to the improvement of cyclic stability and high rate discharge capability. Over all, amorphous Mg0.9Ti0.1Ni showed the best synthesis properties.

[25] Solid-state reactions between Cu and Al during mechanical alloying and heat treatment

Ying DY. Zhang DL. - Journal of Alloys & Compounds. 311(2):275-282, 2000

Solid-state reactions between Cu and Al during mechanical alloying and heat treatment of the as-milled powder with compositions of Cu-14at.%Al and Cu-35at.%Al has been studied by using scanning electron microscopy, differential scanning calorimetry and X-ray diffractometry. It was found that Cu and Al could be easily mechanically alloyed by ball milling of a mixture of Cu and A powders, forming a Cu(Al) solid solution when the composition of the mixture was 14at.%Al; and forming gamma-Cu9Al4 intermetallic compound when the composition was 35at.%Al. It was demonstrated that the same final outcome of the alloying can also be achieved through heat treating the as-milled composite powders. However, it was identified that for Cu-14at.%Al powder, the first phase formed was theta-CuAl2 or gamma-Cu9Al4, whereas for Cu-35at.%Al, the first phase was theta-CuAl2. The refinement of Cu/Al composite structure through milling does not change the nucleation temperature of the first phase during heating but it significantly decreases the peak and end temperature of the nucleation and growth of the dominating phase.

[24] Improved temperature and corrosion behaviour of nanocomposite Nd-2(Fe,Co,M)(14)B/alpha-Fe magnets

Jurczyk M. Jakubowicz J. - Journal of Alloys & Compounds. 311(2):292-298, 2000

The characteristics of the magnetic properties nanocomposite Nd-2(Fe,Co,M)(14)B/alpha-Fe magnets obtained by high energy ball milling and powder metallurgy routes have been improved by appropriate Al-Cr, Cr, Zr additions. Using a single phase close to the stoichiometric composition, nanocomposite Nd-12.6(Fe,Co,M)(81.4)B-6/alpha-Fe magnets with better temperature stability are produced, due to the disappearance of the Nd-rich grain boundary phase in Nd-2(Fe,Co)(14)B/alpha-Fe materials, If the content of the soft magnetic alpha-Fe phase in Nd-2(Fe,Co,M)(14)B/alpha-Fe composities increases, the thermal stability of the coercivity increases, too. For a Nd12.6Fe69.3Co11.6Zr0.5B6/alpha-Fe magnet, containing 37.5 vol% alpha-Fe, the temperature coefficients (from 293 to 413 K) of remanence alpha(J(r)) and coercivity beta(H-j(c)) are: = 0.07 and - 0.35% K-1, respectively. Nanocomposite magnets appears to he more corrosion resistant than sintered Nd-Fe-B magnets.

[23] Electrochemical behaviour of nanostructured Mm(Ni,Al,Co)(5) alloy as MHx electrode

Jurczyk M. Majchrzycki W. - Journal of Alloys & Compounds. 311(2):311-316, 2000

The electrochemical properties of nanocrystalline MmNi(3.5)Al(0.8)Co(0.7) alloy, which has the hexagonal CaCu5 type structure, were investigated. This material was prepared by mechanical alloying (MA) followed by annealing and used as a negative electrode for a Ni-MHx battery. MA process transforms the starting mixture of the elements into an amorphous phase without other phase formation. Heating the MA sample at 1020 K for 0.5 h resulted in the formation of the hexagonal CaCu5-type structure. It was found that the electrodes prepared from the nanocrystalline powders had almost similar discharge capacities, compared with the negative electrode prepared from polycrystalline powders. In the annealed nanocrystalline MmNi(3.5)Al(0.8)Co(0.7) powders discharging capacities up to 135 mAh g(-1) (at 160 mA g(-1) discharge current) were measured (note, that the lanthanum content in mischmetal was only 25 wt%).

[22] Mechanical coactivation of hydrargillite and calcium compounds

Prokof'ev VY. Il'in AP. Sazanova TV. - Inorganic Materials. 36(9):899-903, 2000

The mechanochemical processes in equimolar mixtures of hydrargillite with CaO, Ca(OH)(2), and CaCO3 were studied during activation in a vibratory mill. The chemical reactions involved were identified.

[21] The mechanochemical synthesis and properties of the fullerene trimer C-180

Komatsu K. Fujiwara K. Murata Y. - Chemistry Letters. (9):1016-1017, 2000
A solid-state reaction of C-60 with 4-aminopyridine as a catalyst under high-speed vibration milling conditions afforded fullerene trimer C-180, which was characterized by IR and UV-vis spectroscopies as well as the APCI mass spectroscopy of the cyanated derivative.

[20] Bulk mechanical alloying for solid-state synthesis of functional materials
Aizawa T. Zhou C. - Advanced Engineering Materials. 2(1-2):29-32, 2000
Bulk mechanical alloying is an alternative solid-sate process, that can overcome several intrinsic difficulties in conventional mechanical alloying processes. The present process is adaptable to industrial production of functional alloys and compounds because of short processing times and the absence of contamination. With the aid of theoretical simulations in understanding the mechanical behavior, a pass schedule for each material system can be rationally deduced.

[19] Rapid synthesize of Bi-2223 precursor for the fabrication of superconducting tapes using electrophoretic deposition
Yau JKF. Wong YL. - Physica C. 339(2):79-87, 2000
A fast and economic method of synthesis of a superconducting precursor was developed. The Bi2Sr2CaCu2O8+x superconducting phase with a T-c of 80 K and a mixture of Ca2CuO3, Ca2PbO4, and CuO were synthesized separately. These two powders were then pulverized, blended, and reacted in air at 820-860 degrees C using multi-stage heat treatment with intermediate attrition millings. The process yielded a precursor with a main phase (approximately 72%) of Bi2-deltaPbdeltaSr2Ca2Cu3O10+x in a short total sintering time of 40 h with the elimination of the routine pelletization process in conventional ceramic processing. The optimal heating time between consecutive millings was found to be 8 h, equivalent to a Bi-2223 formation rate of 1.8% per hour of sintering, which was four times quicker than the conventional processing. The J(c) of the Bi-2223/Ag tapes so made by electrophoretic deposition is at the 30 000 A cm(-2) level at 77 K and 0 T.

[18] A low temperature synthesized NbC as grain growth inhibitor for WC-Co composites
Da Silva AGP. De Souza CP. Gomes UU. Medeiros FFP. Ciaravino C. Roubin M. - Materials Science & Engineering A-Structural Materials Properties Microstructure & Processing. 293(1-2):242-246, 2000
Niobium carbide can be used to inhibit WC grain growth in hardmetal. The performance of a NbC powder produced at low temperature by solid-gas reaction (an experimental powder) as WC grain growth inhibitor is compared with that of a commercial NbC powder. It is verified that NbC effectively inhibits heterogeneous WC coarsening. This results in an increase in hardness. The commercial and experimental NbC powders exhibit a comparable performance in inhibiting the WC grain coarsening, in spite of a significant difference in particle size and shape. The commercial NbC powder is very fine while the experimental one is coarse and porous, but its crystallites are finer than those of the commercial product. The milling procedure used to prepare the alloys is able to reduce the particle size of the experimental NbC, and thus guarantee a dispersion of the particles with a quality level comparable to that found for the alloy prepared with the commercial NbC.

[17] Lubricity of metal ethoxide formed on sliding surfaces of Si3N4-TiN-Ti composites in ethanol
Hibi Y. Enomoto Y. Tanaka A. - Journal of Materials Science Letters. 19(20):1809-1812, 2000
[16] Vibrational density of states of nanocrystalline iron and nickel
Bonetti E. Pasquini L. Sampaolesi E. Deriu A. Cicognani G. - Journal of Applied Physics. 88(8):4571-4575, 2000
We present an experimental determination of the vibrational density of states in nanocrystalline Fe and Ni by inelastic neutron scattering. Nanocrystalline specimens with different grain size and microstrain have been prepared by ball milling and thermal annealing. The vibrational density of states has been extracted from neutron time-of-flight spectra obtained with the spectrometer IN6 at the Institute Laue-Langevin. In comparison with reference coarse-grained specimens measured in the same conditions the nanocrystalline specimens exhibit: (i) a modest increase in the population of low-frequency modes and (ii) a distinct broadening of the transverse and longitudinal phonon peaks. The former feature is related to the presence of interface modes and it is critically compared with other observations in pure nanocrystalline metals. The latter is discussed in terms of reduced phonon lifetime due to the nanometric size of the crystallites.

[15] Mechanochemical milling-induced reactions between gases and sulfide minerals I. Reactions of SO2 with arsenopyrite, pyrrhotite and pyrite
Aylmore MG. Lincoln FJ. - Journal of Alloys & Compounds. 309(1-2):61-74, 2000
The mechanochemical milling of arsenopyrite, pyrite and pyrrhotite in the presence of SO2 has demonstrated the potential for inducing gas/solid reactions at low temperature. Both reactants and milled products were characterised by powder X-ray diffractometry and by scanning electron microscopy of polished sections. The gas compositions were determined by mass spectrometry. Milling in an atmosphere of SO2 results in the conversion of arsenopyrite to pyrite via an intermediate pyrrhotite phase. Milling pyrite or pyrrhotite results in a continuous cyclic process where pyrite decomposes to pyrrhotite, which then undergoes resulfurisation back to pyrite.

[14] Effect of nitrogen content on structure and magnetic properties of Nd16Fe84-xBxNy alloys prepared by mechanical alloying
Liu W. Zhang ZD. Sun XK. He JF. Tang H. Cui BZ. Zhao XG. - Journal of Alloys & Compounds. 309(1-2):172-175, 2000
The structure and magnetic properties of Nd16Fe84-xBxNy alloys prepared by mechanical alloying using pyrolytic boron nitride (p-BN) as starting material have been investigated. By increasing the content of boron and nitrogen, the magnetic main phase changes from Nd2Fe17 to Nd2Fe14BNdelta, and finally transforms into the paramagnetic Nd1.1Fe4B4 phase. The nitrogen and boron contents determine the component of phases and magnetic properties. The enhancement of the Curie temperature of the Nd2Fe14BNdelta phase originates from the increase of the interstitial nitrogen content in the Nd2Fe14B lattice.

[13] Ti-TiN hardmetals prepared by in situ formation of TiN during reactive ball milling of Ti in ammonia
Wexler D. Calka A. Mosbah AY. - Journal of Alloys & Compounds. 309(1-2):201-207, 2000

Vapour deposition of titanium nitride on WC/Co or hard ferrous-based cutting tips generally results in significant increases in cutting tool life. However, a major limitation of such nitrided tips is that they cannot be resharpened for re-use. Although monolithic TiN may be too brittle for cutting tool applications, with appropriate microstructural design, Ti-TiN composites should have the required combinations of toughness, ductility, hardness, wear resistance and thermal conductivity to replace coated tips for a range of machining applications. We report the synthesis of monolithic Ti-TiN composites from nanostructural precursor powders. Reactive ball milling of Ti in nitrogen or ammonia under controlled conditions eventually results in the formation of nanostructural TiN. Furthermore, by ending the reaction after an appropriate period a homogeneous and uniform mixture of Ti and TiN phases can easily be produced. Due to the highly reactive, nanostructural nature of the powder product this synthesis route has the potential to eliminate wetting problems generally associated with the current technology of conventional liquid-phase sintering. Moreover, by controlling nitriding gas pressure changes during milling good control of both the Ti to TiN ratio and final crystallite size distributions can be achieved. It was found that precursor Ti-TiN nanostructural powders synthesised in this way can be successfully compacted and liquid phase sintered without sintering aids. Such compacts show high densities and nanoindentation hardnesses in the range of 18-23 cpa. Structural characterization was performed using X-ray analysis, transmission and scanning electron microscopy as well as optical microscopy. The mechanical. properties were characterised using micro- and macroindentation techniques.

[12] Thermoelectric properties of p-type (Bi2Te3)(x)(Sb2Te3)(1-x) prepared via bulk mechanical alloying and hot pressing

Yang J. Aizawa T. Yamamoto A. Ohta T. - Journal of Alloys & Compounds. 309(1-2):225-228, 2000

In the present paper, starting from elemental Bi, Sb and Te granules with 5 N purity and 1-5 mm diameter, p-type single phase (Bi2Te3)(x)(Sb2Te3)(1-x) (x=0.20, 0.225, 0.25, 0.275 and 0.30) thermoelectric materials with high densification (>99% theoretical density) were prepared via bulk mechanical alloying (BMA) and hot pressing (HP). Their thermoelectric properties, are less composition sensitive in the composition range of x less than or equal to 0.25 and are comparable to that of those materials prepared by travelling heater method (THM); the figures of merit of (Bi2Te3)(x)(Sb2Te3)(1-x) are about 3x10(-3)/K. When x>0.25, the figures of merit of (Bi2Te3)(x)(Sb2Te3)(1-x) decreased rapidly with increasing x.

[11] Structural and hydriding properties of MgYNi4: A new intermetallic compound with C15b-type Laves phase structure

Aono K. Orimo S. Fujii H. - Journal of Alloys & Compounds. 309(1-2):L1-L4, 2000

A new intermetallic compound MgYNi4 with C15b(AuBe5)-type Laves phase structure was successfully synthesized by both mechanical milling and casting methods. The structural and hydriding properties of the samples were examined by X-ray diffraction measurement, thermal analysis and hydrogen pressure-composition (p-c) isotherm measurement. The lattice parameter of MgYNi4 was estimated to be a = 0.701 nm, which is ca. 2% smaller than that of YNi2. A plateau (miscibility-gap) pressure was clearly observed in the p-e isotherm during the dehydriding process of the sample synthesized by casting. The maximum hydrogen content is similar to 1.05 mass% (H/M similar to 0.6) under a hydrogen pressure of 4.0 MPa at 313 K, and the enthalpy of hydride formation was calculated to be - 35.8 kJ/mol H-2. The study in this paper reveals, for the first lime, an application potential of MgNi2-based Laves phase structure for practical use as hydrogen storage and transport materials.

[10] Fabrication of nano-sized AlGaN alloy by dry milling and thermal annealing

Cao YG. Chen XL. Lan YC. Li JY. Xu YP. Xu T. Liang JK. - Journal of Alloys & Compounds. 309(1-2):L13-L15, 2000

Al0.61Ga0.39N alloy nano-powders were obtained by a thermal annealing process from the Al+GaN system in NH3 flow. The activation process of nano-sized Al and GaN powders during dry milling in N-2 plays a key role in the formation of the AlGaN alloy. A too high fraction of aluminium leads to AM, while a too low fraction results in insufficient activation of the Al powder. The GaN localized mode and the AIN localized mode of the E-2 phonon frequency, and the one-mode-type behavior of the A,(LO) and A,(TO) phonon frequencies were observed in the Raman spectra of the alloy.

[9] Preparation of Ti3Al intermetallic powder from TiO2-Al2O3 oxides by calcium or magnesium reduction. [French]

Boudebane S. Bouremoum Z. Lemboub S. - Annales de Chimie-Science des Materiaux. 25(5):391-400, 2000

In this paper the results of a study concerning the possibility of obtaining Ti3Al intermetallic powder by calcium or magnesium co-reduction of a Ti and Al oxide mixture performed at 1247 K during 7.2 to 129.6 Ks, in primary vacuum, are presented. The evaporation of the reducing metal is very important, especially in the presence of vacuum. The losses have been reduced by using large particles of reducing metal and a compacted mixture with cylindrical shape of porous samples. In these conditions calcium has shown a better result. The product obtained after milling and leaching by CH3COOH aqueous solution is a Ti-Al alloy powder consisting of TiAl and Ti3Al intermetallics and of an alpha-Ti solid solution with a minimum oxygen content of 0.9% after a holding of 129.6 Ks.

[8] Millimeter sized ferromagnetic Fe-clusters: Formation by mechanical attrition, microstructure and magnetic properties

Ram S. Jorg-Fecht H. - Materials Transactions Jim. 41(7):754-760, 2000

Ferromagnetic Fe-clusters of millimeter size are fabricated by surface deformation and recombination of spherical Fe-particles (1-2 mu m in diameter) by mechanical attrition in a pure argon. The morphology changed from spherical particles to clusters during a non-interrupted attrition for 50 h. The clusters are separated apart and have an ellipsoidal shape with a sharp size distribution. The particles in cluster are interconnected through a structurally disordered surface structure. A strong dipole-dipole (DD) interaction between the particles designs a reduced effective magnetic moment, mu(n) = 2.21 mu(B) per atom, in the clusters if compared with that in the individual particles (e.g., mu(n) = 2.30 mu(B) in 8-20 nm particles). An extended milling for 100h, with 5 mass% addition of a volatile hydrocarbon liquid, recovers the disordered structure with a resolved and refined structure of 8-20 nm particles. The sample, which consists of single magnetic domain particles, exhibits a monotonically increasing value of coercivity H-

c with a decrease of temperature from 300 to 12 K, with H-c = 7.2 kA/m at 295 K and H-c = 150 kA/In at 12 K. A similar temperature dependence of H-c, from 11.9 kA/m at 295 K to 191.7 kA/m at 12 K, appears in the clusters because of intracluster DD interactions. The results are discussed in relation to microstructure and modified magnetic anisotropies of the particles.

[7] Production of fine-microstructural nickel aluminides by wet mechanical alloying process [Japanese]

Doi Y. Akimoto H. Matsuki K. Aida T. Ochiai S. - Journal of the Japan Institute of Metals. 64(7):518-526, 2000

A Ni3Al(gamma') and NiAl(beta) two phase nickel aluminide (Ni-33.9 mol%Al-0.1 mol%B) powder material was fabricated from Ni and NiAl raw powders by mechanical alloying (MA) process followed by hot pressing. The effects of process control agents for milling on the suppression of oxidation and microstructure refinement in powders as well as compaction have been investigated. It was found that hexane as a milling agent was very effective to suppress the oxidation. Especially, a very fine gamma' and beta two phase microstructure was obtained by hot pressing after a wet milling process using a large quantity of hexane enough to separate the powders by the organic agent. The average grain size was about 1.2 mu m Oxygen content was as low as about 0.37 mass%. The change of X-ray diffraction patterns with the heating of the wet MA powders indicated that the (gamma + beta) two phase microstructure was formed at above 773 K by the reaction between the finely dispersed Ni and NiAl phases in the powders. Compression tests were carried out for the compacted specimens at temperatures of 1173 and 1273 K at an initial strain rate range from 1.4 x 10(-4) s(-1) to 5.6 x 10(-2) s(-1). The strain rate sensitivity exponent m was estimated as high as 0.36 to 0.38 at 1173 K and 1273 K, respectively. These results suggest that the compacted specimen can deform superplastically at the strain rate range higher than 10(-2) s(-1).

[6] Limiting resistance of an HMX-based explosive under shock-wave loading

Golubev VK. Medvedkin VA. Pogorelov AP. Skokov VI. - Combustion Explosion & Shock Waves. 36(3):390-394, 2000

The action of shock-wave loading on specimens of an OTK-90 explosive composition is studied, The limiting levels of loading that correspond to the initial stage of explosive conversion of the specimens impacted by steel plates of different thickness are determined. The limiting resistance of the specimens subjected to the gliding detonation of a TP-83 plastic explosive through a polyurethane-foam layer and also to the gliding and normal detonations of a NIL-1 low-density explosive is examined. It is shown that the boundaries of the transition from the purely mechanical failure of OTK-90 to a mechanochemical reaction that were obtained by different methods of shock-wave loading agree well.

[5] Influence of kinetic energy on the formation of Mg2Si

Lu L. Lai MO. Xue WB. Ng SY. - Zeitschrift fur Metallkunde. 91(8):680-685, 2000

The intermetallic compound Mg2Si has been synthesized from elemental Mg and Si powders by ball milling. The rate of formation of Mg2Si was dependent on the size of milling balls. By using different ball sizes and combinations of balls of various sizes in a planetary ball mill, kinetic energy of ball milling was varied. Experimental results showed that small balls may induce faster reactions between Mg and Si compared with bigger balls, although the angular speed was kept constant. The mechanism of the faster reaction with smaller balls is being discussed. Theoretical simulation showed that the total impact energy using smaller balls is higher than that using larger balls, even though the impact energy per hit is much higher with larger balls. This phenomenon is associated with the change in impact angle. Theoretical simulation showed that the efficiency of impact energy decreases with increasing ball size as a result of the change in impact angle.

[4] Bulk nano-scale Fe/Cu multilayers produced by repeated pressing-rolling and their magnetoresistance

Huang B. Ishihara KN. Shingu PH. - Journal of Materials Science Letters. 19(19):1763-1765, 2000

[3] Phase transformation, structure and magnetic properties of Nd-Fe-B-V alloys and their nitrides prepared by mechanical alloying

Liu W. Zhang ZD. Sun XK. Zhao XG. Cui BZ. Geng DY. - Journal of Magnetism & Magnetic Materials. 219(3):253-259, 200

The structure and magnetic properties of mechanically alloyed (MA) Nd10Fe76B8-xV6+x series and their nitrides have been studied. With increasing V content, the magnetic main phase of Nd10Fe76B8-xV6+x series changes from the magnetic phase of Nd2Fe14B-type structure via a metastable Nd(Fe,V)(7) phase with TbCu7 structure to Nd(Fe,V)(12) phase with ThMn12 structure, The easy in-plane magnetization of Nd(Fe,V)(7) and Nd(Fe,V)(12) phases results in rather poor permanent magnetic properties. The V-containing Nd2Fe14B-type phase is partly decomposed upon nitrogenation. Because nitrogen enters into the interstitial sites of the TbCu7-type and ThMn12-type structures, their Curie temperatures are greatly enhanced. The easy magnetization of Nd(Fe,V)(7) with TbCu7, like Nd(Fe,V)(12) with ThMn12 structure, changes from easy in-plane to easy c-axis after nitrogenation.

[2] Microstructures of Fe77-xNixCu1Nb2P14B6 soft magnetic alloys studied by X-ray absorption fine structure

Yin SL. Bian Q. Wei SQ. - Chinese Physics Letters. 17(9):683-685, 2000

Local structures of the mechanically alloyed Fe77-xNixCu1Nb2P14B6 soft magnetic materials have been investigated by x-ray absorption fine structure. The results show that mechanical alloying (MA) can drive the Fc(77-x)Ni(x)Cu(1)Nb(2)P(14)B(6) powder mixture to produce amorphous alloy when the atomic concentration of Fe element is about and over 40%. On the contrary, the MA Fe77-xNixCu1Nb2P14B6 is a solid solution With an fee-like structure in the region of lower Fe atomic concentration (< 22%), preserving a medium-range order around Ni and Fe atoms. Moreover, we have found that the local structure geometry of Fe atom is similar to that of Ni atom for all the MA Fe77-xNixCu1Nb2P14B6 samples. It indicates that the local structures of Fe and Ni atoms in a Fe77-xNixCu1Nb2P14B6 sample only depend on the x value of clement Ni after ball milling.

[1] Progress of solid-state reaction and class formation in mechanically alloyed Zr65Al7.5Cu17.5Ni10

Seidel M. Eckert J. Bacher I. Reibold M. Schultz L. - Acta Materialia. 48(14):3657-3670, 2000

The progress of amorphization in mechanically alloyed Zr65Al7.5Cu17.5Ni10 powder was investigated in detail using x-ray diffraction, Rietveld analysis, magnetic measurements, metallography, as well as scanning and transmission electron microscopy. For this purpose mixtures of elemental powders were used as starting materials and milled for distinct periods of time. Derailed investigations of the microstructural evolution during milling indicate

that the amorphization proceeds by solid-state reaction, similar to what is known fur mechanical alloying of binary alloy systems and other multicomponent alloys. A layered structure typical for mechanically alloyed material arises in the early stages. Alloying of the lamellae, which consist of pure elements, proceeds to some extent via anomalous fast diffusion of small-sized atoms. Besides this, the larger atoms also contribute to alloying. The observed reaction paths are compared with well-known models describing the amorphization by solid-state reaction in binary systems, suggesting that dislocation pipe diffusion plays a decisive role for intermixing the elements and promoting amorphization.

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