RESEAU FRANÇAIS DE MECANOSYNTHESE

Lettre N°74

Mai 2001

183 Groupes de Recherche

(dont 110 à l'étranger / 32 Pays)

Bureau du RFM : E. Gaffet (Président)

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

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1 Nouvelle Adhésion

A. Popovich – Far Eastern State Technical University - Vladivostok

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Le site web du RFM est :
http://www.bls.fr/amatech
Rubrique Pages Sciences et Techniques pour l'Ingénieur (Rubrique Sciences)
? vous y trouverez les anciennes lettres du RFM (accessible par Adobe Acrobat)
les statuts du RFM ainsi que les annonces concernant les JRFM'2001 et quelques éléments mis a jour régulièrement concernant les derniers résultats dans ce domaine.

Bulletin d'adhésion 2001 / Subcription Print

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

Nom/Name : .....Prénom / First Name : .....
Adresse complète / Full Address : .....
.....
Téléphone/ Phone: .....Télécopie (Fax) : .....
e_Mel. / e-Mail : .....
désire adhérer au Réseau Français de Mécanosynthèse /want to become a member of the French Mechanical Alloying Network
Chèque ci joint / Check enclosed in the amount of 100FF

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

The check has to be to the order : Reseau Francais de Mecanosynthèse
(Please do not use Eurocheck, the taxes do correspond to 40% of the amount of the check).

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

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

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

Nom: ..... Prénom: .....
Téléphone: .....Fax:....., E-mail:
Adresse de Facturation:.....
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***,** , Pour les laboratoires propres,UMR ou associés au CNRS, indiquer le code et l'adresse complète de l'Unité. **Une facture sera établie directement à leur encontre.**
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, , , , (nécessaire pour obtenir un discount pour les déjeuners)

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

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

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

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Fiches d'inscriptions et résumés à retourner avant le 31 02 2001 à Luc Aymard
(JRFM 2001) Faculté des Sciences, LRCS
33 rue Saint leu Amiens 80000
tel: 03 22 82 75 74 fax : 03 22 82 75 90 e-mail: luc.aymard@u-picardie.fr

Date limite d'Envoi des résumés: 02 avril 2001

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

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Annonce de congres et / Ou Ecoles
Congress and School Announcements

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

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

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

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

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

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

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

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

(IWSIS-3)
October, 7-12, 2001.
3rd International Workshop on Surface and Interface Segregation , Island of Porquerolles, French Riviera,
This Workshop is devoted to the study of the segregation phenomenon in defects of crystallized solids (surface, grain boundary, interface of interphase...)

INFOS, : http://www.crmc2.univ-mrs.fr/confs/iwsis

"**VI International Symposium on Self-Propagating High-Temperature Synthesis, (SHS-2001)**"
Haifa, Israel . October 14-18, 2001.
More information on the
Web site: **htpp://www.technion.ac.il/technion/materials**

Workshops
Gordon Research Conference on Granular and Granular-Fluid Flow
Plymouth, NH, USA June 30 - July 5 ,2002
http://sol.rutgers.edu/~shinbrot/gordon2002/gordon2002.html

NOUVEAU	**RQ11** Rapidly Quenched and Metastable Materials 25-30 August 2002 Department of Materials, University of Oxford, UK Contact: RQ11 Conference Organiser, Beggars Roost, Channels End Road, , , , , , , , , Comworth Bedford MK44 2NS, U.K. Tel: +44 (0) 1234 378862 Fax: +44 (0) 1234 376219 E-mail: mailto:rq11@materials.ox.ac.uk Website: http://www.materials.ox.ac.uk/rq11

L, A, C, A, M, E, ', 2, 0, 0, 2
EIGTH LATIN AMERICAN CONFERENCE
ON APPLICATIONS OF THE MÖSSBAUER EFFECT
PANAMA, 22-27, SEPTEMBER, 2002.E-mail: mailto:lacame2000@fisica.ciens.ucv.ve
http://www.up.ac.pa/Eventos/lacame2002/inicio.htm

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SOUTENANCES DE THESE
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Cooperative Research on Related Areas
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France (12/04/2001)

Le portail Internet "France Contact" a ete lance: ce portail s'adresse aux chercheurs etrangers sejournant ou ayant sejourne en France et permettra le suivi et l'animation du reseau que constituent les milliers de chercheurs etrangers ayant effectue un sejour scientifique au sein des etablissements et des organismes de recherche francais:
http://www.francecontact.net

Europe (6/03/2001)

The ESF, on the recommendation of the scientific Standing Committee for Physical and Engineering Sciences (PESC), will support, in fields related to PESC's remit, approximately 10 ESF Exploratory Workshops to be held in 2002.
Each workshop will allow 20-25 leading European scientists to explore novel ideas at the European level with the challenging aim to "spearhead" new and preferably inter-disciplinary areas of research.
In specific terms, PESC's 2001 Call is for workshop proposals on R&D subjects which are NOVEL AND PREFERABLY INTERDISCIPLINARY and which concern emerging fields within any of the following areas: chemistry, physics, mathematics, information sciences, fundamental engineering sciences, materials sciences, and technologies research in these areas.
The PESC Call is available at http://www.esf.org/physical/WorkshopCalls/Call2001.htm
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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 : mailto:shhong@sorak.kaist.ac.kr/ mailto: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

SPAIN (03/04/2001)- From J.J. Suñol (joanjosep.sunyol@udg.es)

Postdoctoral researchers required Universitat de Girona

Soft magnetic materials obtained by mechanical alloying and rapid solidification: thermal and structural characterization. Analysis of nanocrystallization process.

The research position will involve aspects of: materials processing by mechanical alloying, thermal and structural characterization by DSC, TG,, XRD, SEM, TEM, TMS; kinetic modeling.

The position will began with effect from september 2001 to september 2002.
Interested candidates should send correspondence to: Dr. J.J. Suñol.
Department of Physics,, EPS (P II). Girona University. E-17071. Girona,
Spain. Fax: 34-972418098.
E-mail: mailto:joanjosep.sunyol@udg.es
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(From Paul J. Warren – 6/03/2001)
A Research Training Network on nanostructured Aluminium alloys is urgently looking for researchers. There are opportunities for Post-doctoral and Pre-doctoral researchers available immediately in Oxford(UK), Grenoble(F), Turin(I), Stockholm(S), Madrid(E), Waterford(IRL), Ioannina(G), Warsaw(PL), and Bratislava(SK). Please pass this information to anyone who may be interested.
For further details please visit the website http://www.materials.ox.ac.uk/nano-al.
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Post Doctoral Fellow Positions - University of Toronto (5/03/2001)
The University of Toronto is seeking three postdoctoral fellows for a major new initiative in laser nanofabrication, material diagnostics, and nano-optics fabrication. State-of-the-art laser-processing facilities and optical material fabrication and diagnostic infrastructure are funded from various government and industrial sources. The research is centered in the Photonics Group of the Department of Electrical and Computer Engineering, and directed by Professor Peter R. Herman.

1 - F2-Laser Nanofabrication Facility The post doctoral fellow will drive the development of precise optical tools and nanofabrication processes in one of the world's forefront facilities for F2-laser nanofabrication research. The record short-wavelength light of 157 nm drives strong interactions in challenging materials at sub-micron feature sizes that are attractive for widespread application in fabricating photonic components, optical circuits, lab-on-a-chip systems, and wireless electronic circuits. Responsibilities include co-supervision of graduate students, coordination of research activities with scientists from academia and industry, and co-management of the novel facility. The $1 million program also includes establishing state-of-the-art optical communication diagnostics. The research goals are new micromachining and photosensitivity processes for fabricating and/or tuning optical circuits, 3-D photonic devices, photonic bandgap structures, and binary optics. These studies are to be integrated with related program in ultrafast laser processing.
2 - Photonic-Bandgap Integrated Optical Circuits An outstanding candidate is sought for a collaborative project to integrate photonic bandgap structures into functional optical circuits. Three-dimensional diffractive optical structures offer in theory, powerful capabilities in managing light in optical circuits. The goal is to practically harness this capability within the structure of our existing photonics fabrication program (the F2-laser nanofabrication facility and ultrafast-laser processing laboratory) and through collaboration with a leading photonic-bandgap group at the University of Toronto. The project is suited to a technically strong and creative individual motivated to revolutionize the future manufacturing of photonic circuits.
3 - Laser-Induced Breakdown Spectroscopy of Aluminum A laser-spectroscopy specialist is required to drive an industrially sponsored research program in laser-induced breakdown spectroscopy of recycled aluminum. The goal is to develop novel laser and diagnostic technology for collecting accurate assays of aluminum metal for a future large-scale pilot project in automobile recycling by Alcan International. One project is the study of a new laser interaction - invented at the University of Toronto - that entails high-repetition 'bursts' of ultrafast laser pulses. This approach promises to cleanly remove surface oxides and precisely probe the underlying bulk aluminum within a single burst. Research centers on fundamental laser interactions and defining laser processing windows in cooperation with our industrial partner.
The research positions entail extensive academic collaboration within the Engineering Faculty, the Department of Physics, the Department of Chemistry, and Photonics Research Ontario (www.pro.on.ca) and with other academic research centers: Laser Labortorium, Goettingen, Germany; National Research Council, Canada; and Optical Fibre Technology Centre, Australia. Research also includes close interaction with world-leading photonics and manufacturing companies in Canada (i.e. JDS Uniphase, Mitel, Raytheon Elcan Optical Technology, Alcan International) and internationally (i.e. Photonics Integrated Research, Lambda Physik, MicroLas). Our principle goals are forefront science and engineering research for public dissemination in high-quality journals and the generation of intellectual property. Successful candidates will lead one of the following three research areas.
Required qualifications for all three positions include a Ph.D. in experimental Physics, Engineering Science, or Electrical Engineering, and experience with several of the following areas: F2 or excimer lasers, ultrafast lasers, optical and opto-mechanical design, photonic devices for optical communications, optical waveguide fabrication and modelling, optical communication diagnostics, photonic bandgaps, laser-matter interaction physics, spectroscopy, and material diagnostics (SEM, FTIR, AFM, SEM, EDX, ESR). An independent and highly motivated person with good technical and communication skills is required. Each position entails a supervisory role with graduate students and other researchers. The successful candidate will also be responsible for coordination and administration of research involving visiting scientists and industrial partners in the local booming Photonics industry.
The postdoctoral positions are available immediately and remain open until filled. Provide a CV, relevant publications, three references, and recent university transcripts by mail, electronically, or by fax:
Professor Peter R. Herman
10 King's College Rd. Tel: 416-978-7722 - Dept. of Electrical and Computer Engineering Fax: 416-971-3020
University of Toronto, Toronto, ON hermanp@ecf.utoronto.ca - M5S-3G4, CANADA
The University of Toronto is Canada's top university, located in the center of Canada's largest and most dynamic city. Toronto is home to a large and diverse immigrant population and has low-crime rates. See more at:
http://www.utoronto.ca/toronto.htm
Further Employment Information: http://www.ecf.utoronto.ca/~hermanp/job_available.htm

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

Metallic Glasses are available immediately in France and several other EU States. Please check the following web page
http://www.inpg.fr/BMG-RTN/
and contact the Coordinator A.R. Yavari at mailto:euronano@ltpcm.inpg.fr
****

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

Livres ou "Special Issues"

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

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

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

(9/06/2000)
"Mechanical Alloying : FABRICATION OF ADVANCED MATERIALS AT ROOM TEMPERATURE" by M. Sherif El-Eskandarany
(ISBN: 977-299-089-7) Published by DAR AL-FIKR AL-ARABI, Cairo-Egypt.
The price of the book is $50, and a special discount (20%) is offered to all the RFM member.
Preface
Mechanical alloying (MA) process using ball-milling and/or rod-milling techniques, has received much attention as a powerful tool for fabrication of several advanced materials, including equilibrium, nonequilibrium (e.g., amorphous, quasicrystals, nanocrystalline, etc.), and composite materials., In addition, it has been employed for reducing some metallic oxides by milling the oxide powders with metallic reducing agents at room temperature. The MA is unique process in that a solid state reaction takes place between the fresh powder surfaces of the reactant materials at room temperature., Consequently, it can be used to produce alloys and compounds that are difficult or impossible to be obtained by the conventional melting and casting techniques.,
This book intended primarily to serve as an introduction to the MA process, including general description of the process, starting material requirements, the equipment, characterizations of the milled powders, and consolidation techniques, which used to compact the powder into fully-dense bulk materials.
The book contains several typical examples of selected advanced materials that have been fabricated by MA. This book is aimed at either senior undergraduate/post graduate students or materials scientists/metallurgists. - M. Sherif El-Eskandarany - April 2000 - Cairo - EgyptContents -
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(05/05/2000)
Extractive Metallurgy of Activated Minerals
included in series Process Metallurgy, 10
by P. Balaz - Institute of Geotechnics, Slovak Academy of Sciences
ISBN : 0 - 444 - 50206 - 8 / Price USD 144, Euro 124.79)
file:///http / // www.elsevier.nl/inca/publication
Description
Mechanical activation of solids is a part mechanochemistry, the science with a sound theoritical foundation exhibiting a wide range of potential application. Mechanical activation istself is an Innovative procedure where an improvement in technological processes can be attained via a combination of new surface area and defects formation in minerals.
Mechanical activation is o exceptional importance in extractive metallurgy and mineral processing and this area forms the topic of this book and is a result of more than twenty years of research and graduate teaching in the field.
In pyrometallurgy, the mechanical activation of minerals makes it possible to reduce their decomposition temperatures or causes such a degree of disordering that the thermal activation may be omitted entirely. The potential mitigation of environmental pollutants is becoming increasingly important in this context.
The lowering of reaction temperatures, the increase of the rate and amount of solubility, preparation of water soluble compounds, the necessity for simpler and less expensive reactors and shorter reaction times are some of the advantages of mechanical activation in hydrometallurgy. The environmental aspects of these processes are particularly attractive.
Several industrial processes are examined and the flowsheets are presented as successfull of activation. In these processes, the introduction of a mechanical activation step into the technological cycle significantly modifies the subsequent steps.
The book is designed for researchers, teachers, operators and students in the areas of extractive metallurgy, mineral processing, mineralogy, solid state chemistry and materials science. It will encourage newcomers to the mechanochemistry to do useful research and discover novel applications in this field.

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

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

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

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

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

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

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

DISPERSION-STRENGTHENED ALUMINIUM PREPARED BY MECHANICAL ALLOYING
Michal Besterci, Institute of Materials Research, Slovak Academy of Sciences, Kosice
In the book, the author describes the theoretical and technological fundamentals of mechanical alloying the Al-C system. Special attention is given to material characteristics, the kinetics and mechanism of mechanical alloying, methods of mixture compaction and heat treatment of compacted parts. Models of dispersoid spatial arrangement, dispersoid evaluation and optimisation and experimental possibilities are discussed. The interpretation of the static and dynamic mechanical properties, especially strength and ductility properties at 20 °C, mechanical properties at elevated temperatures are discussed, with emphasis on the effect of interface, superplasticity, creep and creep-fatigue characteristics. Content
Introduction
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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, (•••••)
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Proceeding du Congrès "Mechanically Alloyed, Metastable and Nancrystalline Materials"- Barcelone (1997)
Editor : M.D. Baro, S. Surinach - Materials Science Forum 269 - 272 (1998)

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

Périodiques

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

[66] RAPID SOLIDIFICATION OF TI-25 MOL%AL ALLOY BY PLASMA SPRAYING

Uenishi K., Murase M. Kobayashi – Materials Transactions JIM. 42 (2) : 269-274 2001;

Mechanically alloyed Ti-25 mol%Al powders were low pressure plasma sprayed in order to produce nanostructured cut intermetallic compound on mild steel. Rapidly quenched sprayed layers with various cooling rates were formed by changing the substrate temperature and spray distance. Mechanically alloyed powders with convoluted structure of pure Al and Ti melted in the plasma flame and completely reacted to form alpha (2) intermetallic compound. The relative density of the sprayed layer increased with the substrate temperature and an almost 100% dense layer was obtained in the case of a substrate temperature over 650 K. The microstructure of the sprayed layer consisted of equiaxed nano at grains, of which size increased with substrate temperature as well. The grain size was reduced down to a minimum of about 200 nm at the substrate temperature of about 500 K. Effect of cooling rate on the grain size was estimated using Boswell's model, which agreed well with the experimental

[65] RESULTS OF HYDROTHERMAL TREATMENT OF THE AMORPHOUS PHASES OBTAINED BY BALL MILLING OF ZEOLITES A, X AND SYNTHETIC MORDENITE

Kosanovic C., Subotic B., Smit I. – Croatica Chemica Acta.; 74 (1) : 195-206 2001

High-energy ball milling of zeolites A, X and synthetic mordenite for an appropriate time results in the formation of true amorphous aluminosilicate phases having the same chemical composition as the starting (unmilled) crystalline materials (zeolites). Since the solubility of thus prepared amorphous solids in hot alkaline solutions is considerably higher than the solubility of the starting zeolites under the same conditions, it can be expected that hydrothermal treatment of the amorphous solids would result in their transformation to more stable phases by solution-mediated processes. To evaluate this thesis, the X-ray amorphous solid phases obtained by high-energy ball milling of zeolites A, X and synthetic mordenite were hydrothermally treated at 80 degreesC by 2 M and 4 M NaOH solution, respectively, for 4 h. The products obtained (zeolites A, P and hydroxysodalite) were characterized by X-ray powder diffraction and particle size distribution measurements. It was concluded that the nuclei for zeolite crystallization originate from the residual nano-sized quasicrystalline particles (short-range ordering of Si and Al atoms inside amorphous regions that have not been completely destroyed during milling). Type(s) of the zeolite(s) (zeolite A, zeolite Pa) crystallized by the growth of the nuclei under the given conditions are determined by the chemical composition of the liquid phase (concentrations of Si and Al), and by the chemical composition of the precursor (determined by the type of mechanochemically amorphized zeolite) and the alkalinity of the system (NaOH concentration in the liquid phase), respectively. The results obtained are in agreement with the thermodynamic stabilities of the zeolite types that may be crystallized under the given conditions and at relative rates of crystallization.

[64] A KIND OF CARBON WHISKERS IN NEW STRUCTURE AND MORPHOLOGY

Dong J., Shen WC., Hu XF., Zhang BF., Liu X., Kang FY., Gu JL., Chen NP. -, Science in China Series B-Chemistry. 44(1):55-62, 2001

Carbon whiskers with new structure and morphology were observed when heating the milled graphite, Transmission electron microscopy (TEM) and high resolution electron microscopy (HREM) show that carbon layers are almost perpendicular to the growth axes of carbon whiskers. Field emission scanning electron microscopy (FESEM) indicates that there are spirals appearing on the surface of the whiskers. The structure analysis shows that the growth mechanism of carbon whiskers is related to the trace amount of ZrC in the heated samples

[63] HYDROGEN IN NANOSTRUCTURED VANADIUM-HYDROGEN SYSTEMS

Orimo S., Kimmerle F., Majer G. - Physical Review B. 6309(9):4307-+, 2001

Nanostructured vanadium-hydrides, beta (2)-VHx, with typical grain sizes of 80 nm (x=0.82), 30 nm (x =0.73), and 10 nm (x=0.67) were prepared by mechanical milling under hydrogen atmosphere. The final grain size, about 10 nm, does not change any more with increasing milling time, and a homogeneous amorphous phase is not formed in this system, even after milling for 300 min. The hydrogen concentration in the grains x(G) decreases with decreasing grain size from x(G)=0.82 in 80-nm grains to 0.72 in 10-nm grains. This indicates a modification of the beta (2)-gamma phase boundary in the V-H system with nanometer-scale grains. The hydrogen concentration in the intergrains, x(IG) approximate to0.5-0.6, is smaller than in the grains, and was found to be nearly independent of the grain size. The hydrogen diffusivity has been studied by NMR measurements of the proton spin-lattice relaxation Gamma (1). Generally, the measured Gamma (1) consists of contributions that result from both hydrogen in the grains and in the intergrain regions. Due to the smaller spin-spin relaxation rate Gamma (2) of the protons in the intergrain regions, their contribution to Gamma (1) could be measured separately by the spin-echo technique. The relaxation data indicate that, at a given temperature, the hydrogen diffusivity in the intergrain regions is substantially higher than inside the grains. The frequency dependence of the dipolar contribution Gamma (1,dip) reveals a distribution in the activation enthalpy for hydrogen in the intergrain regions. This distribution was found to be the broader the smaller the grain size. A change in the diffusion mechanisms, presumably arising from the beta (2)-delta phase transition, takes place at about 200 K. The exchange of hydrogen atoms between the grains and the intergrain regions occurs very slowly and is negligible on the time scale given by Gamma (1

[62] EFFECTS OF HEAT TREATMENT AND ALLOYING ELEMENTS ON THE MICROSTRUCTURES AND MECHANICAL PROPERTIES OF 0.15 WT PCT C TRANSFORMATION-INDUCED PLASTICITY-AIDED COLD-ROLLED STEEL SHEETS

Kim SJ., Lee CG., Choi I., Lee S. - Metallurgical & Materials Transactions A-Physical Metallurgy & Materials Science. 32(3):505-514, 2001 The main emphasis of this study has been placed on understanding the effects of manganese and silicon additions and of heat-treatment (intercritical annealing and isothermal treatment) conditions on the microstructures and

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mechanical properties of 0.15 wt pet C transformation-induced plasticity (TRIP)-aided cold-rolled steel sheets. The steel sheets were intercritically annealed and isothermally treated at the bainitic region. Microstructural observation and tensile tests were conducted, and volume fractions of retained austenite were measured. Steels having a high manganese content had higher retained austenite fractions than the steels having a low manganese content, but showed characteristics of a dual-phase steel such as continuous yielding behavior, high tensile strength over 1000 MPa, and a low elongation of about 20 pct. The retained austenite fractions and mechanical properties varied with the heat-treatment conditions. In particular, the retained austenite fractions increased with decreasing intercritical annealing and isothermal treatment temperatures, thereby resulting in the improvement of the elongation and strength-ductility balance without a serious decrease in the yield or tensile strength. These findings suggested that the intercritical annealing and isothermal treatment conditions should be established in consideration of the stability of austenite and the solubility of alloying elements in the austenite formed during the intercritical annealing

[61] SYNTHESIS OF COO/NI COMPOSITE POWDERS FOR MOLTEN CARBONATE FUEL CELLS

Fukui T., Okawa H., Hotta T., Naito M., Yokoyama T. - Journal of the American Ceramic Society. 84(1):233-235, 2001

CoO/Ni composite particles were prepared by the advanced mechanical-coating method railed Mechanofusion(TM). These composite particles were composed of nickel particles uniformly covered with fine CoO particles. A new cathode structure for molten carbonate fuel cells (MCFCs), where the NiO core was coated with an outer layer of lithiated cobalt and nickel solid-solution oxide (Li(Co,Ni) oxide), was formed by oxidation and lithiation using these CoO/Ni composite particles. The solubility of nickel in this Li(Co,Ni) oxide layer into carbonate melt decreased to two-thirds of that of NiO when used as a cathode for MCFCs.

[60] MECHANOCHEMICAL SYNTHESIS AND ELECTROCHEMICAL PROPERTIES OF LIMN2O4

Choi HJ., Lee KM., Kim GH., Lee JG. - Journal of the American Ceramic Society. 84(1):242-244,

Spinel LiMn2O4 as a cathode material for lithium secondary batteries has been synthesized by a mechanochemical process, and its electrochemical properties have been characterized. Highly disordered nanocrystalline LiMn2O4 powders have been prepared by the mechanochemical processing of Li2O and MnO2 powder mixtures for 24 h. Electrochemical characterization of mechanochemically processed powder has shown that the intercalation of Li+ takes place with an initial capacity of 167 mA.h/g in the 2.5-4.3 V range and has better capacity retention as compared to the well-ordered crystalline LiMn2O4 powders. The better capacity retention of the mechanochemically processed LiMn2O4 powder may be attributed to the highly disordered structure that could accommodate the Jahn-Teller distortion of the spinel structure during Li+ intercalation around the 3 V region.

[59] LOCAL STRUCTURES OF MECHANICALLY ALLOYED FE100-XCUX SOLID SOLUTIONS STUDIED BY X-RAY ABSORPTION FINE STRUCTURE

Wei SQ., Yan WS., Fan JW., Li YZ., Liu WH., Wang XG. -, Journal of Synchrotron Radiation. 8(Part 2):770-772, 2001

The local structures of the immiscible Fe100-xCux alloys (x= 0, 10, 20, 40, 60, 80 and 100) produced by mechanical alloying have been investigated by XAFS. For the Fe100-xCux (x greater than or equal to 40) solid solutions, the local structures around Fe atoms change from bcc structure to fcc one and the Cu atoms maintain the original coordination geometry after milling for 160 hours. On the contrary, the local structures around Cu atoms in both of Fe80Cu20 and Fe90Cu10 alloys appear a transition from fcc to bcc structure. We found that the Debye-waller factor sigma of fcc Fe-Cu phase is larger than that of bcc Fe-Cu phase, and the sigma (0.099 Angstrom) around Fe atoms is larger than that (0.089 Angstrom) of Cu in the Fe100-xCux (x greater than or equal to 40) solid solutions. This suggests that the mechanically alloyed Fe100-xCux supersaturated solid solution is not a homogeneous alloy, and consists of Fe-rich and Cu-rich regions for various compositions. A possible mechanism for bcc-to-fcc and fcc-to-bcc changes in Fe100-xCux solid solutions is discussed in relation to the interdiffusion and transition induced by the ball milling

[58] XANES SPECTRA OF MECHANICAL ALLOYED Y-CU SYSTEM

Nakai I., Murakami Y., Shibai Y. -, Journal of Synchrotron Radiation. 8(Part 2):812-814, 2001

We report changes in the structure and the electronic states of YCu2 during mechanical alloying. The x-ray diffraction shows that milling for about 60 h transforms mixture of elemental powders of Y and Cu into an amorphous alloy. We have measured the x-ray absorption near edge structure (XANES) spectra of mechanically alloyed YCu2 at Cu K and Y K edges at various milling time. The pre-edge peak near the Cu K threshold grows remarkably and its central energy decreases with increasing the milling time. The absorption near the Y K threshold, on the other hand, decreases with milling time. We discuss these features of XANES spectra in connection with the phase transformation from the crystalline to amorphous states

[57] XANES STUDY IN THE SOLID STATE REACTION OF ZR-NI SYSTEM

Nakai I., Shibai Y., Murakami Y. -, Journal of Synchrotron Radiation. 8(Part 2):815-817, 2001

We have measured x-ray absorption near edge structure (XANES) spectra of mechanically alloyed ZrNi near Ni and Zr K edges as a function of milling time. The x-ray diffraction shows that the system is transformed into an amorphous phase by milling for about 60 h. With increasing the milling time, a small absorption near the Ni threshold rises and finally forms a peak in the amorphous phase, while an absorption near the Zr threshold shows a gradual decrease. The peak of the Ni K edge reflects 3d character strongly hybridized with 4p states, while the absorption of the Zr K edge comes from states having a 4d orbital character

[56] LOCAL STRUCTURE EVOLUTION OF FEXNI77-XCU1-NB2P14B6 SOFT MAGNETIC MATERIALS BY MECHANICAL ALLOYING

Yin SL., Wei SQ., Bian Q., Li ZR. -, Journal of Synchrotron Radiation. 8(Part 2):889-891, 2001
Mechanically alloyed FexNi77-xCu1Nb2P14B6 soft magnetic materials have been prepared with different atomic compositions. The alloy structures are investigated by X-ray absorption fine structure (XAFS). The results show that mechanical alloying (MA) can drive the FexNi77-xCu1Nb2P14B6 powder mixture to produce amorphous alloy while the atomic concentration of Fe element is about and over 40%. On the contrary, the MA FexNi77-xCu1Nb2P14B6 is a solid solution with a fcc-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 FexNi77-xCu1Nb2P14B6 samples. It indicates that the local structures of Fe and Ni atoms in a FexNi77-xCu1Nb2P14B6 sample only depend on the x value of element Ni after ball milling.

[55] TRACE LEVELS OF MECHANOCHEMICAL EFFECTS IN PULVERIZED POLYOLEFINS
Ganglani M., Torkelson JM., Carr SH., Khait K. - Journal of Applied Polymer Science. 80(4):671-679, 2001
This research investigated the structural changes that occur on different polyethylene polymer systems as a result of a novel pulverization process called solid-state shear pulverization ((SP)-P-3). High-density polyethylene, low-density polyethylene, and two forms of linear low-density polyethylene were run through a pulverizer under high shear conditions as well as low shear conditions. The physical properties were examined before and after the pulverization via melt index, melt rheology, GPC, and DSC, techniques. The low shear pulverization did not noticeably alter the physical properties of the polymers. In contrast, high shear pulverization did result in an increase in viscosity as observed by melt index and oscillatory shear experiments, although solid-state and bulk properties as observed by DSC and GPC were not affected. These results indicate that a small amount of mechanochemically induced changes occur as a result of the pulverization process, including incorporation of a small amount of long-chain branches randomly placed on a few of the polymer chains. No evidence of short-chain branching resulting from (SP)-P-3 processing was found in these systems

[54] A 4 V LITHIUM-ION BATTERY BASED ON A 5 V LINIXMN2-XO4 CATHODE AND A FLAKE CU-SN MICROCOMPOSITE ANODE
Xia YY., Sakai T., Fujieda T., Wada M., Yoshinaga H. -, Electrochemical & Solid-State Letters. 4(2):A9-A11, 2001
A flake Cu-Sn microcomposite alloy was prepared by a mechanical alloying technique for use as large volumetric capacity, highly compact negative electrode material for rechargeable lithium batteries. A 4 V lithium-ion cell based on such a Cu-Sn alloy anode and a 5 V LiNixMn2 - xO4 cathode was tested. The preliminary results reported in this work show that the cell has an average working voltage at 4.0 V, and cycles well with a reversible capacity of ca. 200 mAh/g based on the pure Cu-Sn alloy when a cell was cycled between 3.5 and 4.6 V.

[53] ANODE PROPERTIES OF AMORPHOUS 50SIO CENTER DOT 50SNO POWDERS SYNTHESIZED BY MECHANICAL MILLING
Morimoto H., Tatsumisago M., Minami T. -, Electrochemical & Solid-State Letters. 4(2):A16-A18, 2001
Amorphous 50SiO . 50SnO (mol %) powders were synthesized by mechanical milling treatment of starting materials SiO and SnO in a dry N-2 atmosphere at room temperature. The resultant powders were used in a rechargeable cell, Li/1 M LiPF6, ethylene carbonate+diethylene carbonate/50SiO . 50SnO. For the first discharge at a current density of 1.5 mA cm(-2), the high capacity over 800 mAh g(-1) was obtained for the potential range of 0 to 2.0 V vs. Li/Li+. This first discharge capacity of amorphous 50SiO . 50SnO powders was much larger than that of amorphous materials in the system SnO-B2O3-P2O5 obtained by mechanical milling reported previously. In addition, irreversible capacity of the former was smaller than that of the latter. The amorphous 50SiO . 50SnO powders synthesized by mechanical milling treatments are one of the promising candidates as anode materials for lithium-ion secondary batteries.

[52] NANOCRYSTALLINE FE-40AL COATING PROCESSED BY THERMAL SPRAYING OF MILLED POWDER
T. Grosdidier, A. Tidu, H.-L. Liao -, Scripta Materialia, 44 (3) (2001) 387 - 393

[51] PHASE TRANSFORMATION IN NANOSTRUCTURED MATERIALS PRODUCED UNDER HEAVY PLASTIC DEFORMATION
X Sauvage, L Thilly, F Lecouturier, A Guillet, K Hono, D Blavette- ADVANCES IN MECHANICAL BEHAVIOUR, PLASTICITY AND DAMAGE, VOLS 1 AND 2, PROCEEDINGS, 2000, pp 847-852 - EUROPEAN CONFERENCE ON ADVANCES IN MECHANICAL BEHAVIOUR, PLASTICITY AND DAMAGE (EUROMAT 2000); TOURS, FRANCE. NOVEMBER 7-9, 2000
Cu-Nb-0.18 (%vol.) composite wires and pearlitic steel wires (steel cord) were produced by cold drawing. The high level of plastic deformation leads to the formation of nanostructured materials through grain refinement. These two kinds of wires were investigated using 3D Atom-Probe and Transmission Electron Microscopy (TEM) to exhibit their nanoscaled structure. Experimental data on steel cords revealed the dissolution of cementite lamellae which thickness was reduced down to a few nanometres during drawing. The microstructure of Cu/Nb wires was also mapped out in 3D. Nanoscale Nb fibres and Cu channels with smooth Cu/Nb interfaces attributed to stress-induced diffusion were exhibited. These new experimental results give rise to new arguments to account for the enhanced mechanical properties of cold drawn pearlitic steel wires and Cu/Nb nanocomposite wires.

[50] FRACTOGRAPHIC CHARACTERIZATION OF AL-AL3TI SAMPLES PRODUCED BY MECHANICAL-ALLOYING
JM Gallardo, JA Rodriguez, FG Cuevas, EJ Herrera - ADVANCES IN MECHANICAL BEHAVIOUR, PLASTICITY AND DAMAGE, VOLS 1 AND 2, PROCEEDINGS, 2000, pp 1481-1486 - EUROPEAN CONFERENCE ON ADVANCES IN MECHANICAL BEHAVIOUR, PLASTICITY AND DAMAGE (EUROMAT 2000); TOURS, FRANCE. NOVEMBER 7-9, 2000
Aluminium-matrix composites with up to 26vol% Al3Ti reinforcing particles have been prepared by mechanical alloying Al and -up to- 10wt%Ti elemental powders, followed by an optional degasification treatment. Powders have been characterized at this stage. Consolidation have been carried out by double cold pressing + sintering. Near-full density samples have been tensile-tested at room and high temperature. These aluminium-matrix composites can show tensile strengths in excess of 500

MPa. Properties are recovered after high temperatures (<400<degrees>C) treatments. Nevertheless, Al-Al-3,Ti composites show a limited ductility, usually under a 5% axial elongation. In this paper the fractographic features, under SEM observations, are reported: fracture initiation site, fracture surface appearance, intermetallics' nature and quantification at the fracture surface, etc. Tn addition, metallographic quantification of second phases has been carried out at sections far from the fracture plane. It can be said that phases other than the Al-Ti intermetallics usually reduce ductility. For instance, Al-Fe intermetallics are clearly deleterious. Occasional coarse Al-Ti particles are at the fracture orygin. Processing defects, such as compaction cracks may be found at some fracture surfaces. Discussion on possible improvements is included.

[49] THE EFFECT OF MECHANICAL ALLOYING PROCESS ON THE SHAPE OF W PARTICLE IN THE LIQUID PHASE SINTERING OF CU-W COMPOSITE POWDER

JH Hyun, MJ Suk, JS Kim, YS Kwon - KORUS 2000: 4TH KOREA0RUSSIA INTERNATIONAL SYMPOSIUM ON SCIENCE AND TECHNOLOGY, PT 3, PROCEEDINGS, 2000, pp 268-276 - 4TH KOREA-RUSSIA INTERNATIONAL SYMPOSIUM ON SCIENCE AND TECHNOLOGY (KORUS 2000); ULSAN, SOUTH KOREA. JUNE 27-JULY 1, 2000

In general, W particles in liquid Cu are observed to be spherical (nonfaceted), showing no anisotropy in solid-liquid interfacial energy. However, the morphology of W particle in liquid Cu was observed to be faceted during the liquid phase sintering of mechanically alloyed W-Cu composite powder. The present work describes the morphological variation of W-particle which occurs during liquid phase sintering of Cu-5wt%W composite powder prepared by mechanical milling process. As the milling process proceeds, the time needed to attain equilibrium nonfaceted morphology is increased.

[48] IN-SITU INTERMETALLIC MATRIX COMPOSITES FABRICATED BY MA-PDS PROCESS

YH Park, BG Park, SH Ko - KORUS 2000: 4TH KOREA0RUSSIA INTERNATIONAL SYMPOSIUM ON SCIENCE AND TECHNOLOGY, PT 3, PROCEEDINGS, 2000, pp 309-314 - 4TH KOREA-RUSSIA INTERNATIONAL SYMPOSIUM ON SCIENCE AND TECHNOLOGY (KORUS 2000); ULSAN, SOUTH KOREA. JUNE 27-JULY 1, 2000

In-situ intermetallic matric composites were fabricated by MA-PDS process. Matrix wa Fe-28at.%Al and in-situ reinforcements were TiC and TiB2. Mechanical alloying wa carried out using a vibratory mill. For the TiC reinforced composites, milling time wa systematically changed from 1 to 400 hours to observe the effect of milling parameter. For the TiB2 reinforced composites, volume fraction of reinforcements was systematically changed from 0 to 25at.%. Mechanically alloyed powders were sintered in the plasma discharge sintering system. Fe3Al matrix and in-situ reinforcements, that is, TiC and TiB particles were successfully synthesized by in-situ process using MA-PDS process.

[47] PULSE ELECTRIC CURRENT SINTERING OF BALL-MILLED MOLYBDENUM DISILICIDE

YH Kim, JH Kang, HT Kim, JS Kim, YS Kwon - KORUS 2000: 4TH KOREA0RUSSIA INTERNATIONAL SYMPOSIUM ON SCIENCE AND TECHNOLOGY, PT 3, PROCEEDINGS, 2000, pp 315-320 - 4TH KOREA-RUSSIA INTERNATIONAL SYMPOSIUM ON SCIENCE AND TECHNOLOGY (KORUS 2000); ULSAN, SOUTH KOREA. JUNE 27-JULY 1, 2000

Effect of milling on densification behavior of MoSi2 powder during SPS(Spark-Plasma Sintering) process was investigated. MoSi2 starting powder with an avg. Size of 10 mum was milled to reduce the size to <1<mu>m. Sintering was performed in a pulse electric current sintering facility, varying the conditions of sintering temperature (1200-1500 degreesC), holding time (1-15min.) and heating rate(20-200K/min.). Changes in relative density and the densification rate as a function of temperature were determined. Microstructure of sintered compact was observed and analyzed by SEM and EPMA. Sintered density of milled powder specimens was lower (94-95% relative density) than that of the unmilled ones (94-98%), even though the densification rate of the former was higher than that of the latter in the early and middle stage of sintering. These contradictory results could be explained by oxygen pick-up during the milling process from 0.3 to 1.8 w/o, which seems to be related with a formation of silicon oxide in MoSi2 powder and its decomposition at high temperature above 1200 degreesC accompanied by formation of gas phase.

[46] MECHANOCHEMICAL PRODUCTION AND INVESTIGATION OF NANOCOMPOSITE THERMOELECTRIC CERAMICS ON THE BASE OF HEAVY MULTICOMPONENTS DOPED BETA-FESI2

E Belyaev, G Suchkova, A Ancharov, S Avramchuk, N Slavnykh, S Mamylov, O Lomovsky - KORUS 2000: 4TH KOREA0RUSSIA INTERNATIONAL SYMPOSIUM ON SCIENCE AND TECHNOLOGY, PT 3, PROCEEDINGS, 2000, pp 359-361 - 4TH KOREA-RUSSIA INTERNATIONAL SYMPOSIUM ON SCIENCE AND TECHNOLOGY (KORUS 2000); ULSAN, SOUTH KOREA. JUNE 27-JULY 1, 2000

The iron disilicide is a perspective thermoelectric material for generator, available for mass production. It has low efficiency (ZT similar to0.2-0.4). There are ways to level up the efficiency: particles size decreasing (to nanoscale), nonconventional alloying elements and multicomponent doping, heterophases additives inputting, 2D (3D) superlattice production. The aim of this work is to synthesise mechanochemically the nanocomposite on the base of doped beta -FeSi2 and to investigate the influence of multycomponent doping on the thermoelectric properties. The mechanical alloying of elements was carry out in intensive planetary ball mill AGO-2, ISSC SE RAS construction, the ball acceleration was 600 m/sec(2) The intensity factor was varied by the different balls diameter (3-15 mm). The samples of powders were analyzed by the X-ray diffractometry. After mechanical alloying, the samples phase content was the mixtures of FeSi, beta -FeSi2 and Fe(Si). The average particle sizes were 200-1000 nm. The reaction sintering leads to the nanocomposites with 20-100 nm grains. After compacting and low temperature annealing a phases content was the thermoelectric beta-iron disilicide. The dopants status and electrical characteristics were investigated.

[45] MECHANOCHEMICAL PROCESSING OF GOLD-BEARING SULPHIDES

Welham NJ. - Minerals Engineering. 14(3):341-347, 2001

Samples of pure pyrite and arsenopyrite and a gold-bearing pyrite /arsenopyrite concentrate have been mechanically milled in inert and oxidising atmospheres. Pyrite was found to be essentially inert with only slight oxidation to FeSO4 evident only after 100 h milling in oxygen. Arsenopyrite completely oxidised to As2O3 and FeSO4. The milled concentrate was more complex and showed quartz, pyrite and an unidentified phase as the products of milling in oxygen. Leaching of the milled concentrate in 3% HCl showed 93% dissolution leaving quartz and pyrite as the only phases present. The gold, which was present only in the arsenopyrite, remained in the solid residue which would be expected to be readily treated by alkaline cyanidation. Thus it appears that milling in oxygen allows selective oxidation of arsenopyrite over pyrite providing an alternative, low temperature process for extracting gold from these types of ore

[44] WET BOND MILL TEST

Tuzun MA. - Minerals Engineering. 14(3):369-373, 2001

The Bond grindability test is currently used in the minerals industry to provide data fundamental to the design of commercial milling installations. In some instances it was found that the work index for the fine limiting sizes (such as 53 mum) was abnormally high. Observations of the test procedure suggested that the dry screening procedure seemed likely to give rise to errors., Other alternative modified Bond test procedures were discussed to solve this problem. Wet Bond milling and screening rests were carried out to avoid incomplete screening of the circulating load at fine sizes. Because the work index required for dry milling was greater than for wet milling, in order to calculate the standard Bond index, the Bond index obtained from wet milling had to be multiplied by 1.3. The results from the dry and wet tests correlated very well.

[43] MECHANOCHEMICAL SYNTHESIS OF INTERMETALLIC COMPOUNDS [REVIEW] [RUSSIAN]

Grigorieva TF., Barinova AP., Lyakhov NZ. -, Uspekhi Khimii. 70(1):52-71, 2001.

The current state of studies in the mechanochemical synthesis in binary metallic systems is considered. It is shown that this method is suitable for the synthesis of intermetallic compounds and solid solutions in the concentration boundaries of the equilibrium state diagrams of many binary systems. It is shown that the mechanochemical approach is most promising for the preparation of intermetallic compounds with systems with great differences between the melting points and the densities of the initial compounds, phases with a nanometer grain size and metastable phases. The main factors influencing the concentration boundaries of the existence of non-equilibrium solid solutions prepared by the mechanochemical method. It is demonstrated using numerous examples that the formation of solid solutions can be represented by several stages. At the first stage, nano-sized layered composite structures are formed with simultaneous dispersion of the initial components (the formation of a great contact area); the second stage is the synthesis of intermetallic compounds in nano-sized layered composites; at the third stage, the intermetallic compounds are disserved in the metal solvent to give a solid solution

[42] NANO-COMPOSITE SMFE7CX/.ALPHA-FE PERMANENT MAGNET

Geng DY., Zhang ZD., Cui BZ., Liu W., Zhao XG., Yu MH. – J. Magnetism & Magnetic Materials. 224(1):33-38, 2001

The structure, phase transformation and magnetic properties of the Sm19Fe67C14 alloy prepared by mechanical alloying (MA) and subsequent re-milling have been studied systematically. With increasing re-milling time, the magnetic main phase, Sm2Fe14C (Nd2Fe14B-type structure), changes via a metastable SmFe7Cx phase (TbCu7-type structure) to Sm-carbide (NaCl-type structure). Consequently, the easy magnetization direction changes from the basal phase for Sm2Fe14C to the c-axis for SmFe7Cx. The optimal values of M-r/M-s = 0.81 and (BH)(max) = 6.8 MGOe have been achieved for nano-composite SmFe7Cx/alpha -Fe permanent magnet.

[41] STRUCTURE AND MAGNETIC PROPERTIES OF SMXCO5/ALPHA-FE (X=0.65-1.3) PREPARED BY MECHANICAL MILLING AND SUBSEQUENT ANNEALING

Zhang J., Zhang SY., Zhang HW., Shen BG., Li BH. - Journal of Applied Physics. 89(5):2857-2860, 2001

Powder mixtures of SmxCo5 (x = 0.65-1.3) + 20 wt % alpha -Fe were mechanically milled. Annealing these as-milled powders results in the formation of a mixture of the hard phase Sm-(Co, Fe) and the soft phase Fe-Co. For the as-milled Sm1Co5 + 20 wt % alpha -Fe powder, the hard phase changes with the increase of annealing temperatures. The optimal maximum energy product (BH)(max) is obtained in the powder annealed at 550 degreesC for 30 min. Depending on the Sm content in the as-milled SmxCo5 (x = 0.65-1.3) + 20 wt % alpha -Fe powders, the hard phases can be 1:7, 1:5, or 2:7 phase after a heat treatment at 550 degreesC for 30 min. The coercivity of 6.5 kOe and maximum energy product of 17.8 MGOe is achieved for the powder with x = 1.0. The highest coercivity of 9.67 kOe is achieved for the powder with x = 1.2. From the measurements of the coercivity obtained from minor hysteresis loops, it is concluded that the coercivities of this type of magnets are controlled mainly by the domain wall pinning

[40] PRODUCTION OF IRON-BASE PARTICLE DISPERSION ALLOYS USING SIGMA-PHASE ALLOY POWDER [JAPANESE]

Wanikawa S., Ohtaguchi M., Muramatsu Y. -, Journal of the Japan Institute of Metals. 64(12):1156-1161, 2000

In this study, we investigated a method for producing iron-base particle dispersion alloys of Fe-13Cr-3W-0.5Ti-(0.17 similar to0.83) Y2O3(mass%) using sigma -phase alloy powder as a starting material for mechanical alloying(MA). The alloy powder was prepared by crushing a Fe-43Cr-10W-1.7Ti(mass%) alloy containing brittle sigma -phase. The powder obtained was mixed with iron and Y2O3 powders. The mixture was then subjected to MA, and the MA powder was consolidated by hot working. In the study, we especially examined the formation of sigma -phase with heat-treatment conditions and the milling characteristics of sigma -phase alloys. We also examined the MA characteristics of the mixture and the mechanical properties together with microstructure of the consolidated dispersion alloys., The formation of the sigma -phase varied with heat-treatment temperature and time. Alloys containing more than 75 vol% of sigma -phase could be easily pulverized by stamping and milling. The powder mixture consisting of iron, sigma -phase alloy and Y2O3 powders exhibited excellent MA characteristics, and its MA was accomplished within 72 ks. Y2O3 particle addition inhibited recrystallization and resulted in the refinement of structure. TEM observation and EDS analysis revealed that dispersoids in the alloy consolidated at 1203 K were mainly composed of titanium and oxygen, but yttrium content was small. This fact was considered to cause the solid solution of Y2O3 particles into iron-base alloy during the MA process. The tensile strength of dispersion alloys increased markedly with increasing Y2O3 content, and their elongation decreased with an increase of the strength. The results of tensile tests carried out at 923 K were comparable or superior to those reported by other authors

[39] THE THERMAL EXPANSION COEFFICIENT OF MECHANICALLY ALLOYED AL-CU-FE QUASICRYSTALLINE POWDERS

Korsunsky AM., Salimon AI., Pape I., Polyakov AM., Fitch AN. - Scripta Materialia. 44(2):217-222,

[38] SYNTHESIS OF CU DISPERSED AL2O3 NANOCOMPOSITES BY HIGH ENERGY BALL MILLING AND PULSE ELECTRIC CURRENT SINTERING

Kim YD., Oh ST., Min KH., Jeon H., Moon IH. - Scripta Materialia. 44(2):293-297, 2001

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

[37] REACTION SINTERING OF PARTIALLY REACTED SYSTEM FOR PZT CERAMICS VIA A HIGH-ENERGY BALL MILLING
Kong LB., Ma J., Zhu W., Tan OK. - Scripta Materialia. 44(2):345-350,

[36] A MATHEMATICAL MODEL OF NUCLEATION IN LIQUID METALS ON ULTRADISPERSE CERAMIC PARTICLES
Authors Kalinina AP., Cherepanov AN., Poluboyarov VA., Korotaeva ZA. - Russian Journal of Physical Chemistry. 75(2):227-233, 2001
A mathematical model of nucleation and growth Of the crystalline phase in metals modified by mechanically activated ceramic nanoparticles was suggested. The influence of the size of particles and of the type of their plating metallic coating on structure formation and the size of crystalline grains was studied. It was shown that the dispersity of the structure increased as the characteristic diameter of activated particles decreased, and the difference of the work functions between the metal of the plating coating and the melt (if the metal expanded when melted) increased when all other conditions were equal.

[35] CRYOGENIC MECHANICAL ALLOYING AS AN ALTERNATIVE STRATEGY FOR THE RECYCLING OF TIRES
Smith AP., Ade H., Koch CC., Spontak RJ. - Polymer. 42(9):4453-4457, 2001
Cryogenic mechanical alloying (CMA) is investigated as a viable strategy by which to produce highly dispersed blends composed of thermoplastics and tire, thereby providing a potentially new route by which to recycle discarded tires, Morphological characterization of these blends by near-edge X-ray absorption fine structure (NEXAFS) microscopy demonstrates that, upon CMA, ground tire is highly dispersed within poly(methyl methacrylate) (PMMA) and poly(ethylene terephthalate) (PET) matrices at sub-micron size scales. Incorporation of polyisoprene (PI) homopolymer into the blends to improve dispersion efficacy is also examined. Neither PI nor the tire is found to interact chemically with PMMA or PET under the milling conditions employed here

[34] A COMPARATIVE ANALYSIS OF MECHANISMS, THERMODYNAMICS, AND KINETICS OF THE MECHANICAL ALLOYING IN FE(68)M(32) (M = SI, SN) SYSTEMS
Dorofeev GA., Ul'yanov AL., Konygin GN., Elsukov EP. - Physics of Metals & Metallography (English Translation of Fizika Metallov i Metallovedenie). 91(1):44-52, 2001
The detailed study of the processes of mechanical alloying for the Fe-32 at. % Si system was carried out using X-ray diffraction, Mossbauer spectroscopy. and magnetic measurements. The results are compared with those for the Fc-32 at. % Sn system obtained under the same milling conditions. The influence of the type of the material of the milling body of the planetary ball mill on the process and products of the mechanical synthesis was also studied for the Fe-Si system, model thermody nain ic calculations within the framework of the Miedema model were carried out in order to determine the energetic driving forces of transformations. Mechanisms of the accelerated mass transfer during the mechanical alloying of the Fc-Si and Fe-Sn systems are proposed.

[33] ALLOYING BCC IRON WITH CARBON UPON INTENSE COLD DEFORMATION
Shabashov VA., Mukoseev AG., Sagaradze VV. - Physics of Metals & Metallography (English Translation of Fizika Metallov i Metallovedenie). 91(1):68-74, 2001
Formation of carbon solid solution (up to 2 at.%) in bcc iron upon cold deformation (300 K) by shear (epsilon = 6.7) under high pressure was studied by Mossbauer spectroscopy in a mixture of armco iron and thermal black. The Mossbauer spectra of the Fe-C solid solutions formed upon martensite transformation and by mechanical alloying were compared

[32] THERMAL STABILITY OF NANOCRYSTALLINE FCC AND HCP NI(SI) SYNTHESIZED BY MECHANICAL ALLOYING OF NI90SI10
Datta MK., Pabi SK., Murty BS. - Philosophical Magazine Letters. 81(2):77-84, 2001
The thermal stability of nanocrystalline fcc and hcp Ni(Si), obtained by mechanical alloying of Ni90Si10, has been studied. The allotropic transformation from fee to hcp Ni(Si) is accompanied by a volume expansion of 8.6% and is observed when fee Ni(Si) reaches a critical crystallite size of 10 nm. The hcp phase transforms to stable fcc Ni(Si) at 573 K. It has been identified that the lattice distortion in nanometre-sized crystallites from the equilibrium configuration and the decrease in the interfacial energy with grain refinement act as self obstacles in controlling the grain growth of nanocrystalline materials

[31] INITIAL STAGES OF THE TRANSFORMATION OF SINGLE-CRYSTAL ANATASE PARTICLES DURING HIGH-ENERGY BALL MILLING
Girot T., Devaux X., Begin-Colin S., Le Caer G., Mocellin A. - Philosophical Magazine A-Physics of Condensed Matter Defects & Mechanical Properties. 81(2):489-499, 2001
The initial steps of the phase transformation of anatase by high-energy ball milling have been followed as a function of milling time by X-ray diffraction and transmission electron microscopy (TEM). The metastable TiO2 II phase appears after several minutes of grinding. The anatase-TiO2 II transformation occurs without particle fracture. TEM shows the simultaneous strain hardening of anatase particle cores and the formation of TiO2 II crystallites at the surface of anatase particles. The TiO2 II crystallites have an average diameter of about 10 nm. The possible mechanisms of the transformation are commented upon.

[30] MECHANOCHEMICAL SYNTHESIS OF HYDROXYAPATITE FROM CALCIUM OXIDE AND BRUSHITE
Yeong B., Xue JM., Wang J. -, Journal of the American Ceramic Society. 84(2):465-467, 2001
Fine hydroxyapatite (HA) powders were prepared by mechanically activating a mixture of calcium oxide and brushite powders in a high-energy shaker mill. A defective HA phase was formed when the starting powder mixture was activated for less than or equal to 20 h. When the mixture was calcined at 800 degreesC, it was converted to beta -tricalcium phosphate. In contrast, a nanocrystalline HA phase was formed when the mechanical activation was extended to 30 h. The material was transformed to a HA compound (Ca-10(PO4)(6)(OH)(2)) of high crystallinity when it was calcined at 800 degreesC.

[29] PREPARATION OF LI2S-P2S5 AMORPHOUS SOLID ELECTROLYTES BY MECHANICAL MILLING
Hayashi A., Hama S., Morimoto H., Tatsumisago M., Minami T. - Journal of the American Ceramic Society. 84(2):477-479, 2001
Amorphous solid electrolytes in the Li2S-P2S5 system were prepared successfully from a mixture of crystalline Li2S and P2S5, using a mechanical milling technique. The amorphous-forming region,vas extended to higher Li2S compositions by mechanical milling, compared with melt quenching. The pelletized samples of the 75Li(2)S . 25P(2)S(5) (on a mole-percent basis) amorphous powders obtained by mechanical milling for 20 h exhibited high conductivity (2 x 10(-4) S/cm at room

temperature) and an activation energy for conduction of 34 kJ/mol. The lithium-ion transport number of the amorphous powders was almost unity.

[28] CRYSTALLOGRAPHIC AND ELECTRONIC STRUCTURE OF CUXFE4-XN

de Figueiredo RS., Foct J., dos Santos AV., Kuhnen CA. - Journal of Alloys & Compounds. 315(1-2):42-50, 2001 9

In the present work, the electronic and the crystallographic structures of y'-CuxFr4 N-x Perovskite nitrides have been determined. Mechanical alloying has been used to obtain these nitrides, meanwhile fully ordered y'-CuFe3N single phase could not be obtained except up to approximate to 12 at% Cu (y'-Cu0.6Fe3,4N). The measured lattice parameter tr = 0.378 nm is near the well known y'-Fe4N nitride (a = 0.377 nm). Order phenomena during thermal aging have been established and discussed on the basis of Mossbauer results. Self-consistent LMTO calculations were performed for y'-CuFe3N fully ordered compound. The calculated magnetic moment was calculated to be 6.18 /(B) per unit cell. Also theoretically determined results were compared with Mossbauer data (extrapolated for the ideal cast) in terms of isomer shift and magnetic hyperfine field.

[27] MECHANOCHEMICAL SYNTHESIS OF MOB2 AND MO2B5

Kudaka K., Iizumi K., Sasaki T., Okada S. - Journal of Alloys & Compounds. 315(1-2):104-107, 2001

Ball-milling of elemental powder mixtures without external heat application has been utilized as a process for the mechanochemical synthesis of high melting compounds. Molybdenum and amorphous boron elemental powder mixtures of atomic ratios of 1:2 and 2:5 were comminuted for 10-40 h in a planetary ball-mill. MoB2 was partially formed after 10 h of milling using tungsten carbide balls in both cases. The single phase of MoB2 (hexagonal) was found by XRD after 40 and 30 h of milling of Mo-B (1:2) and Mo-B (2:5), respectively. By annealing the as-milled Mo-B (1:2) mixed powder at temperatures above 1000 degreesC, a mixed phase of MoB2 and Mo2B5-x type (rhombohedral) was formed, whereas by annealing the as-milled Mo-B (2:5) mixed powder at temperatures between 1000 and 1500 degreesC, a single phase of the Mo2B5-x type was obtained. The lattice parameters of the molybdenum bur ides obtained agreed with previously reported data. Increased contamination of the Mo-B (2:5) mixture compared with the Mo-B (1:2) mixture was found. The mechanochemical reactions were the diffusion-controlled reaction type.

[26] CONSOLIDATION BEHAVIOR OF NANOCRYSTALLINE AL-5AT.%TI ALLOYS SYNTHESIZED BY CRYOGENIC MILLING

Choi JH., Moon KI., Kim JK., Oh YM., Suh JH., Kim SJ.- Journal of Alloys & Compounds. 315(1-2):178-186, 2001

Nanocrystalline powders of aluminum with titanium addition of 5 atomic percentage (Al-5at.%Ti) were prepared by cryogenic milling (CM) at -85 degreesC. The mean particle and average grain sizes of powders prepared by cryogenic milling were 6 mum and 16 nm, respectively and those of powders produced by room temperature milling (RM) were 19 mum and 31 nm, respectively. Since dynamic recovery was suppressed and fracture was promoted during CM. the particle and grain sizes of Al-5at.%Ti powders were effectively reduced by Chi. The powders synthesized by CM were consolidated to full density by vacuum hot pressing (VHP). No serious grain growth was detected because the consolidation of nanocrystalline powders was possible at low temperature for short time. In this study, the smallest grain size, 34 nm, was observed in the specimen VHPed at 390 degreesC fur 10 min with the pressure of 500 MPa. As a result. CRI powder exhibits better sinterability than RM powder revealing CM powder reached the full density at 390% while RM powder reached the lull density at 450 degreesC on the same consolidation conditions. During the consolidation of nanocrystalline Al-5at.%Ti powder by VHP, pure Al region was formed at a triple junction, which was previously pored region, of the powder particles. The length of the pure Al region was a few mum and the grain size in this region was 100 nm. It is considered that the pure Al region was formed by relatively small Al particles with energetically enhanced surface and existing between the large particles during consolidation

[25] METAL OXIDES AS CATALYSTS FOR IMPROVED HYDROGEN SORPTION IN NANOCRYSTALLINE MG-BASED MATERIALS

Oelerich W., Klassen T., Bormann R. - Journal of Alloys & Compounds. 315(1-2):237-242, 2001

Nanocrystalline MgH2/MexOy - and Mg2NiH4/MexOy-powders were produced by high energy ball milling (MexOy=Sc2O3, TiO2, V2O5, Cr2O3, Mn2O3, Fe3O4, CuO, Al2O3, SiO2). The hydrogen absorption and desorption kinetics of the nanocomposite materials were determined with respect tu a technical application. Some of the selected oxides lead to an enormous catalytic acceleration of hydrogen sorption compared to pure nanocrystalline materials. In absorption. the catalytic effect of TiO2,V2O5, Cr2O3, Mn2O3, Fe3O4, and CuO is comparable. Concerning desorption, the composite material containing Fe3O4 shows the fastest kinetics followed by V2O5, Mn2O3, Cr2O3 and TiO2. Only 0.2 mole% of the catalysts is sufficient to provide a fast sorption kinetics.

[24] NDDYFEBZR HIGH-COERCIVITY POWDERS PREPARED BY INTENSIVE MILLING AND THE HDDR PROCESS

A., Gebel B., Gutfleisch O., Muller KH., Schultz L., McGuiness PJ. Drazic G., Kobe S. - Journal of Alloys & Compounds. 315(1-2):243-250, 2001

A comparative study of tilt: processing of highly coercive, isotropic NdFeB-type magnet powders was carried out using two different techniques, Nd15Fe77B8 alloys with additions of Dy (1 at.%) and Zr (0.1, 0.3 and 0.7 at.%) were processed by: (a) a combination of intensive milling-and-annealing and (b) the hydrogenation-disproportionation-desorption-recombination (HDDR) process. A marked retarding effect on grain growth due to the Zr addition was observed. intensively milled and annealed samples containing both Zr and Dy additions showed a large improvement in coercivity in comparison with the additive-free alloys, reaching an optimum value of 2.5 T for 0.1 at.% Zr and 1.0 at.% Dy. The improved microstructure resulted in a wide processing window in which high-coercivity material could be produced. A ZrB2, lamellar phase was observed using transmission electron microscopy; this phase appears to have a grain-growth-inhibiting effect during HDDR processing of NdDyFeBZr materials. A maximum coercivity of 1.9 T was obtained fur the HDDR-processed material. At recombination temperatures above 800 degreesC explosive grain growth was observed using Kerr microscopy.

[23] EFFECTS OF TI, NB AND ZR DOPING ON THERMOELECTRIC PERFORMANCE OF BETA-FESI2

Ito M., Nagai H., Katsuyama S., Majima K. -, Journal of Alloys & Compounds. 315(1-2):251-258, 2001

The effects of Ti, Nb and Zr doping on the thermoelectric performance of a hot-pressed beta -FeSi2 were investigated. Ti doping did not have a significant influence on the thermoelectric properties. Nb doping decreased the electrical resistivity over the entire temperature range. The thermoelectric power of the Nb-doped samples showed lower values below 800 K and

higher values above this temperature than those of the non-doped sample. The figure of mel it of the Nb-doped samples showed higher values in a high temperature range as compared to the non-doped sample. In the case of the Zr-doped samples. the the thermoelectric power was markedly deteriorated below 900 K. In contrast, in the higher temperature range, the thermoelectric power was enhanced by Zr-doping. The electrical resistivity was significantly decreased by Zr doping. The hot-pressed Fe0.94Zr0.06Si2 showed around 20 mu Omegam over the entire temperature range. These values of electrical resistivity are extremely low as compared to the beta -FeSi2 doped with other elements, particularly in a low temperature range. The figure of merit for the Zr-doped samples was significantly enhanced in a high temperature range. The maximum figure of merit, 0.67x10(-5)/K, was obtained at 1064 K for Fe0.94Zr0.06Si2, which was ten times larger than that of the non-doped sample at the same temperature. Thus, it is evident that Zr doping is quite effective for enhancement of the performance of beta -FeSi2, in a high temperature range.

[22] MECHANICAL ALLOYING DURING CRYOMILLING OF A 5000 AL ALLOY/ALN POWDER: THE EFFECT OF CONTAMINATION

Goujon C., Goeuriot P., Delcroix P., Le Caer G. - Journal of Alloys & Compounds. 315(1-2):276-283, 2001

Elemental powders of 80 vol% 5000 Al alloy (3 wt% Mg) and 20 vol% AlN were milled either in liquid nitrogen or at room temperature under argon. The milling of the mixture involved changes in the chemical composition: Fe contamination, oxidation and in-situ nitridation. The effects of milling time and temperature on the contamination of the system were analysed. Oxidation and in-situ nitridation were characterized by a LECO analyser and thermal desorption measurements, whereas Mossbauer spectroscopy was used to study the mechanical alloying of the Al alloy. The results show that a metastable solid solution of Mg and Fe in Al is formed during cryomilling. The occurrence of mechanical alloying in spite of the very low milling temperature is interpreted as a consequence of the fine crystallite size of the Al matrix

[21] PRODUCTION OF SHORT CARBON NANOTUBES WITH OPEN TIPS BY BALL MILLING

Pierard N., Fonseca A., Konya Z., Willems I., Van Tendeloo G., Nagy JB. - Chemical Physics Letters. 335(1-2):1-8, 2001

Short multi-wall carbon nanotubes can be obtained by ball milling. The average length of the ball milled carbon nanotubes, synthesised by decomposition of acetylene on different types of supported metal catalysts, is ca, 0.8 mum The cleavage was caused by the collision between one agate ball and the nanotube powder contained in an agate mortar.

[20] AMORPHIZATION BY MECHANICAL ALLOYING IN METALLIC SYSTEMS WITH POSITIVE GIBBS ENERGY OF FORMATION - ART. NO. 064202

Bai HY., Michaelsen C., Gente C., Bormann R. -, Physical Review B. 6305(6):4202-+,

Fe-W has been chosen as a model system to investigate amorphization during mechanical alloying in systems With positive Gibbs energy of formation. Depending on the overall compositions, amorphous phases and supersaturated body-centered-cubic (bcc) Fe-W solid solutions were obtained by mechanical alloying. The thermodynamics of the system was determined by the calculation-of-phase-diagram (CALPHAD) method. The analysis shows that the Fe-W system exhibits a positive heat of mixing in the bcc: solid solution, and a negative heat of mixing in the amorphous phase. As a result, the amorphous phase has a lower (however, still positive) Gibbs energy of formation than the solid solution in the concentration range of 17-42 at. % W, indicating that amorphization in this range is favored, in agreement with the experiments. The mechanism which allows amorphization and formation of solid solutions upon milling to occur in the Fe-W system is discussed. It is proposed that the elastic contribution to the excess enthalpy which originates from coherent interfaces between the elemental components provides a major driving force for alloying in the Fe-W system

[19] MECHANICAL ALLOYING, FINE STRUCTURE AND THERMAL DECOMPOSITION OF NANOCRYSTALLINE FCC-FE60CU40

Yang YZ., Zhu YL., Li QS., Ma XM., Dong YD., Wang GM., Wei SQ. - Physica B. 293(3-4):249-259, 2001

The solid dissolution of Fe atoms into Cu matrix induced by mechanical alloying and subsequent thermal decomposition of Fe atoms from the solid solution in composition of Fe60Cu40 have been studied by X-ray diffraction (XRD), Mossbauer spectroscopy and the extended X-ray absorption fine structure (EXAFS) technique. The disappearance of elemental Fe and Cu XRD peaks and the presence of FCC structural XRD peaks illustrate the formation of FCC-Fe60Cu40 solid solution. Meanwhile, the new sextet spectrum with a broadening hyperfine magnetic field distribution also demonstrates that the alloying is on an atomic level and there exist complex coordination environments in the solid solution. EXAFS results Further prove the reality of atomic alloying from the clear observation of Fe atoms taking on FCC coordination in the solid solution. Additionally, a large reduction in the first shell coordination number for a center iron atom but not for a center Cu atom indicates the composition non-uniformity, which suggests that Fe atoms enrich the surface while Cu atoms enrich the core of a FCC nanocrystal. The variation of Mossbauer spectra against the annealing temperatures during thermal decomposition indicates that the Fe atoms at the surface readily nucleate and cluster into alpha -Fe at a temperature slightly below 250 degreesC, whereas the Fe atoms in the core of nano-sized crystals first cluster into gamma -Fe cohering to the FCC matrix at a temperature about 350 degreesC and then transform to alpha -Fe for further annealing at a higher temperature or for a longer time

[18] NANOSTRUCTURED MATERIALS IN MULTICOMPONENT ALLOY SYSTEMS

Eckert J., Reger-Leonhard A., Weiss B., Heilmaier M. - Materials Science & Engineering A-Structural Materials Properties Microstructure & Processing. 301(1):1-11, 2001

Production of bulk nanostructured composites with amorphous matrix revealing a significant supercooled liquid region was carried out by die casting and mechanical alloying (MA) and subsequent consolidation at elevated temperatures. Multiphase materials with different volume fractions of nanocrystalline precipitates were prepared from as-cast fully amorphous samples by isothermal annealing. In contrast. MA powders were blended with insoluble metallic and oxide particles upon milling. The different samples were analyzed by X-ray diffraction (XRD), differential scanning calorimetry (DSC), scanning electron microscope (SEM) and transmission electron microscopy (TEM), and viscosity measurements. The mechanical behavior of cast samples was investigated using constant (true) compression rate tests at strain rates ranging from 1 x 10(-5) to 3 x 10(-3) s(-1). The Newtonian viscous how behavior of the composites at temperatures around T-g is mainly triggered by the homogeneous how of the supercooled liquid. The easy flow behavior above T-g was used to consolidate bulk dense specimens from mechanically alloyed composite powders. Microhardness measurements at room temperature reveal a substantial increase of the hardness of the composites due to the uniform distribution of nanoscale particles.

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[17] SYNTHESIS OF NANOCRYSTALLINE MATERIALS - AN OVERVIEW
Froess FH., Senkov ON., Baburaj EG - Materials Science & Engineering A-Structural Materials Properties Microstructure & Processing. 301(1):44-53, 2001
This paper reviews research work at the Institute for Materials and Advanced Processes (IMAP), University of Idaho, on the synthesis of nanocrystalline materials and their consolidation, Nanocrystalline materials have been synthesized by a number of far from equilibrium processes. including mechanical alloying (MA). mechanochemical processing (MCP), supercritical fluid processing (SCFP), and severe plastic deformation (SPD). Examples of the materials include the Ti-Al based intermetallic compounds and composites produced by MA and SPD, Ti base alloys and metal carbides synthesized by MCP, thin film Cu produced by SCFP, and Al-Fe alloys produced by SPD. Details of the processes used and the enhancement of properties due to the nanoscale structures in consolidated material will be presented. The potential of these processes to substitute for conventional methods of production will also be discussed

[16] NANOCRYSTALLINE ZIRCONIA POWDERS SYNTHESISED BY MECHANOCHEMICAL PROCESSING
Dodd AC., Tsuzuki T., McCormick PG. - Materials Science & Engineering A-Structural Materials Properties Microstructure & Processing. 301(1):54-58, 2001
Mechanochemical processing of zirconium and yttrium chloride precursors with lithium hydroxide has been used to synthesise ultrafine powders of yttria-stabilised zirconia. The precursors reacted during milling to form a composite consisting of nanocrystalline oxide grains embedded within a matrix of lithium chloride. The ultrafine powder was recovered subsequently by removing the lithium chloride through washing with deionised water and methanol. The powders were characterised using X-ray diffraction (XRD), transmission electron microscopy (TEM), and BET gas adsorption. The sintering behaviour of cold pressed pellets was examined by dilatometry

[15] SOLID STATE REACTIONS IN NANOMETER SCALED DIFFUSION COUPLES PREPARED USING HIGH ENERGY BALL MILLING
Zhang DL., Ying DY. - Materials Science & Engineering A-Structural Materials Properties Microstructure & Processing. 301(1):90-96, 2001
Solid state reactions during heating of diffusion couples prepared by high energy ball milling mixtures of elemental powders have been studied. It has been shown that when the size of the diffusion couples is reduced and the atomic diffusivity is enhanced through prolonged milling, the temperatures for activating the solid state reactions decrease significantly. In the AI-Ti and Cu-Al systems, the phases formed during heating the mechanically prepared nanometer scaled diffusion couples are the same as those formed during mechanical alloying and during low temperature annealing of multilayer thin films prepared by using sputtering

[14] ZN4SB3(-C-7) POWDERS AS A POTENTIAL ANODE MATERIAL FOR LITHIUM-ION BATTERIES
Cao GS., Zhao XB., Li T., Lu CP. -, Journal of Power Sources. 94(1):102-107, 2001
The electrochemical properties of beta -Zn4Sb3 and Zn4Sb3-C-7 as new lithium-ion anode materials were investigated. The reversible capacities of the pure Zn4Sb3 alloy electrode and 100 h milled Zn4Sb3 in the first cycle reached 503 and 566 mA h/g, respectively, but the cycle stability of Zn4Sb3 whether milled or not were obviously bad. It was demonstrated that cycle stability of Zn4Sb3 could be largely improved by milling after mixing with graphite. It was shown that Zr4Sb3-C-7 composite has a lithium-ion extraction capacity of 581 mA h/ g at the first cycle and 402 mA h/g at 10th cycle

[13] SINGLE MAGNETIC DOMAIN PRECIPITATES OF FE/CO AND FE AND CO IN CU MATRIX PRODUCED FROM (FE-CO)/CU METASTABLE ALLOYS
Nascimento VP., Passamani EC., Takeuchi AY., Larica C., Nunes E. - Journal of Physics-Condensed Matter. 13(4):665-682, 2001
Structural and magnetic properties of nanocrystalline Fe2Co and (Fe2Co)(0.30) Cu-0.70 alloys prepared by high energy ball milling have been studied basically by x-ray, Mossbauer spectroscopy and magnetization measurements. For the Fe2Co alloy case, the Mossbauer measurements indicate that the sample with 160 hours of milling has two magnetic components with the same average hyperfine parameters: one magnetic crystalline component associated with the bcc Fe2Co phase and another component attributed to the small particles of the same bcc Fe2Co phase (SP-Fe2Co). (Fe2Co)(0.30)Cu-0.70 alloys have been prepared by milling in two different ways: (I) starting from the mixture of Fe2Co milled alloy and pure Cu powders (sample I);Ind (2) milling of the elemental powder mixture of Fe, Co and Cu (sample II). The x-ray diffraction and bulk magnetization results of samples I and II indicate the formation of a (Fe2Co)(0.30)Cu-0.70 supersaturated solid solution, with features of a ferromagnetic material and T-c at about (420 +/- 1) K. High temperature magnetization measurements of the (Fe/Co)Cu milled materials show particle precipitation effects. Heat treatment at 675 and 875 K of the final milled materials leads to different results: in the sample I case to the precipitation of single magnetic Fe/Co particles into the Cu matrix, and in the case of sample II the precipitation of single magnetic particles of Fe and of Co into the Cu matrix

[12] THERMAL STABILITY OF NANO-RUAL PRODUCED BY MECHANICAL ALLOYING
Liu KW., Mucklich F. -, Acta Materialia. 49(3):395-403,
The thermal stability of as-milled nano-RuAl has been studied by isothermal annealing at high temperatures. All three kinds of structural evolutions in as-milled powders upon high temperature exposure, namely reordering, strain relaxation and grain growth, show signs of stagnation. The total quantity of impurities, mainly 15 at.% Fe has been analyzed as being dissolved substitutionally in RuAl and also segregated to grain boundaries. Upon grain growth, lattice diffusion and segregation of impurity atoms in grain boundaries have been verified by the lattice parameter variation. The incremental apparent activation energy for grain growth at different temperatures is related to the accumulation of impurities in grain boundaries. Reordering and strain relaxation processes that accompany grain growth could consume a certain part of the driving force for grain growth

[11] FORCED MIXING AND NANOSCALE DECOMPOSITION IN BALL-MILLED CU-AG CHARACTERIZED BY APFIM
Wu F., Bellon P., Melmed AJ., Lusby TA. -, Acta Materialia. 49(3):453-461, 2001
Ag50Cu50 alloys are prepared by high energy ball milling at different controlled temperatures, 85 K, 315 K and 453 K, with milling times long enough to reach steady-state. Atom probe field ion microscopy (APFIM) is used to characterize the atomic mixing forced by low temperature milling and to study the nanocomposite materials stabilized by elevated temperature milling. A new method is devised that makes it possible to prepare sharp tips from ball-milled powders. Statistical analysis of

the APFIM composition profiles is used to determine the degree of mixing as a function of the length scale. These results are compared with the ones obtained from kinetic Monte Carlo simulations. Cryo-milling results in nearly random mixing of copper and silver, whereas the mixing achieved by milling at 315 K is calculated to be around 70%. 453 K milling results in the decomposition into copper-rich and silver-rich regions at a scale of approximate to 25 nm.

[10] COARSENING KINETICS AT 600 DEGREES C OF AL4C3 DISPERSOIDS IN MECHANICALLY ALLOYED AL-TI-O-C

Barlow IC., Jones H., Rainforth WM. -, Scripta Materialia. 44(1):79-86,

[9] SYNTHESES OF NI2SI, NI5SI2, AND NISI BY MECHANICAL ALLOYING

Lee WH., Lee JH., Bae JD., Byun CS., Kim DK. -, Scripta Materialia. 44(1):97-103,

[8] MAGNETIC LOCALIZATION AND FIELD-DEPENDENT VARIABLE-RANGE HOPPING IN DISORDERED CUCR2S4 - ART. NO. 052412

Muroi M., Street R., McCormick PG. - Physical Review B. 6305(5):2412-+,

A study has been made of the magnetic and transport properties of CuCr2S4 powder compacts consisting of nanosized crystallites synthesized by mechanical alloying of the constituent elements at ambient temperature. It is found that the material is a typical spin glass with a spin freezing temperature of about 30 K, and that the temperature dependence of resistivity (rho) is well described by In(rho/rho (o))=(T-o/T)(1/4) in both the high-temperature (> 100 K) and low-temperature (< 50 K) ranges with different values of T-o. The magnetoresistance, defined as {<rho>(0)- rho (50 kOe)}/rho (0). increases monotonically with decreasing temperature and reaches 0.3 at 5 K. It is shown that the temperature and field dependence of resistivity is consistently described in terms of spin-dependent variable-range hopping of the Cr t(2g) electrons localized by magnetic disorder

[7] DIRECT PHASE TRANSFORMATION FROM HEMATITE TO MAGHEMITE DURING HIGH ENERGY BALL MILLING

Randrianantoandro N., Mercier AM., Hervieu M., Greneche JM. - Materials Letters. 47(3):150-158,

Hematite alpha -Fe2O3 powder was milled with a dispersing liquid (ethanol) for different times using a conventional planetary ball mill equipped with a steel vial. Both high resolution transmission electron microscopy (HRTEM), X-ray diffraction and zero- and in-field Mossbauer spectrometry measurements reveal that the nanostructured powders contain maghemite, suggesting that our milling conditions favour the direct transformation from alpha -Fe2O, to gamma -Fe2O3. Both the origin and the kinetics of the transformation are discussed in terms of mechanical aspects

[6] THE EFFECT OF BALL-MILLING SOLVENT ON THE DECOMPOSITION PROPERTIES OF BA(PB1-XBIX)O-3

Chang MC., Wu JM., Cheng SY., Chen SY. - Materials Chemistry & Physics. 69(1-3):226-229,

Ba(Pb1-xBix)O-3 compound, which exhibits perovskite structure is a superconducting material. It can be a useful material for resistor when x value equals 0. The conducting behavior of BaPbO3 is liable to be affected during aqueous processing. In contrast, the phenomenon is not found in Ba(Pb0.8Bi0.2)O-3 The milling solvents of water and ethanol have different effect on the stability of perovskite phase. The decomposition of BaPbO3 into BaCO3 and PbO2 is found when CO32- ion exists. The partial substitution of Bi3+ stabilizes the perovskite phase. The stabilization and decomposition of perovskite phase explain the resistivity change with different milling solvents

[5] ELECTRODE CHARACTERISTICS OF NANOCRYSTALLINE (ZR, TI)(V, CR, NI)(2.41) COMPOUND

Majchrzycki W., Jurczyk M. -, Journal of Power Sources. 93(1-2):77-81,

The electrochemical properties of nanocrystalline Zr0.35Ti0.65V0.85Cr0.26Ni1.30 alloy, Which has the hexagonal C14 type structure, have been investigated. This material has been prepared using mechanical alloying (MA) followed by annealing. The amorphous phase forms directly from the starting mixture of the elements, without other phase formation. Heating the MA samples at 1070 K for 0.5 h resulted in the creation of ordered alloy. This alloy was used as negative electrode for Ni-MHx battery. The electrochemical results show very little difference between the nanocrystalline and polycrystalline powders, as compared with the substantial difference between these and the amorphous powder. In the annealed nanocrystalline Zr0.35Ti0.65V0.85Cr0.26Ni1.30 powders discharging capacities up to 150 mA h g(-1) (at 160 mA g(-1) discharging current) have been measured. The properties of nanocrystalline electrode were attributed to the structural characteristics of the compound caused by mechanical alloying

[4] THERMAL STABILITY OF NANOCRYSTALLINE WC-CO POWDER SYNTHESIZED BY USING MECHANICAL MILLING AT LOW TEMPERATURE

He JH., Ajdelsztajn L., Lavernia EJ. - Journal of Materials Research. 16(2):478-488,

Nanostructured WC-18% Co powder was synthesized by using cryogenic mechanical milling, and the thermal stability of the nanostructured powder was investigated in detail. The results indicated that the as-synthesized WC-18% Co powder had an average WC particle size of 25 nm. Growth of WC particles occurred above 873 K; however, the average WC particle size remained smaller than 100 nm in the powder isothermally heated for 4 h at 1273 K. Thermal exposure in air at T < 623 K did not result in significant oxidation of the cryomilled powder. The thermal exposure did promote the formation of WO2 and WO3 oxides. The Co6W6C phase was detected by x-ray diffraction in the powder heated in nitrogen at 1273 K, and the phases associated with decarburization of WC, such as W2C, W3C phases, were not observed. With increasing temperature, the dissolution of W and C elements in the Co matrix led to a gradual increase in {111} crystallographic plane spacing, eventually leading to the formation of an amorphous phase

[3] MAGNETIC AND MAGNETOTRANSPORT PROPERTIES OF NANOCRYSTALLINE AG0.85FE0.15 AND AG0.70FE0.30 ALLOYS PREPARED BY MECHANICAL ALLOYING

Gomez JA., Xia SK., Passamani EC., Giordanengo B., Baggio-Saitovitch EM. – J. Magnetism & Magnetic Materials. 223(2):112-118, 2001

The magnetic and magnetotransport properties of nanocrystalline Ag0.85Fe0.15 and Ag0.70Fe0.30 alloys have been studied by Mossbauer spectroscopy, magnetization and resistivity measurements. The samples were prepared by mechanical alloying of Fe and Ag powders in a high-energy ball mill. Mossbauer spectroscopy and magnetic measurements of the final milled samples indicate the presence of single-domain 'Fe' particles. The magnetoresistance values, at 4.2 K and for a magnetic field of 8 T, are 2.5% and 5.7% for samples Ag0.85Fe0.15 and Ag0.70Fe0.30, respectively. The magnetoresistance behavior indicates the cluster-glass-like features in both the final milled samples

[2] EFFECT OF PRECURSOR MILLING ON MAGNETIC AND STRUCTURAL PROPERTIES OF BAFE12O19 M-FERRITE

Garcia RM., Ruiz ER., Rams EE., Sanchez RM. -, Journal of Magnetism & Magnetic Materials. 223(2):133-137, 2001
BaFe12O19 fine particles were synthesized after milling a precursor obtained as an intermediate in the sol-gel method. The samples were analyzed by X-ray diffraction. scanning electron microscopy and vibrating sample magnetometry. The milling process favors the formation of the BaM phase and therefore, provides a better specific magnetization and smaller grain size compared to the same preparation route but without the milling step. We report the magnetic and structural properties of the ferrite samples obtained from milled and non-milled precursors

[1] MODIFICATION OF LOW-GRADE CERIA BY HIGH-ENERGY MECHANICAL MILLING: CHANGES IN PHASE COMPOSITION, REDUCIBILITY, AND OXYGEN STORAGE CAPACITY

Dean JM., Chun W., Jen HW., Benson DA., McCabe RW., Graham GW. -, Applied Catalysis A-General. 207(1-2):379-386, 2001
Cerium concentrate, a mixture of ceria (about 60 wt.%) and other rare-earth (mostly lanthanum) oxides, partially transforms into a solid solution upon high-energy mechanical milling. Temperature-pro rammed reduction of the milled material resembles that of the high-oxygen-storage material, ceria-zirconia, but the kinetics of oxygen removal, observed in pulse experiments with either CO or H-2, are much slower. The oxygen storage capacity of a Pd catalyst made with the milled material is found to be less than that of one made with unmilled material when measured on a short (<1 min) time scale

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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*
Affiliations: IAMP, Tohoku University (Japan), *Ecole des Mines d'Albi (France)

Conférences orales

11) J. Foct, A. Legris, R.S. de Figueiredo
"Expériences virtuelles de mécanosynthèse : quand la simulation dévoile ce que les examens réels cachent"
Laboratoire de Métallurgie Physique et Génie des Matériaux - (L.M.P.G.M.) - UMR CNRS 8517 / Université des Sciences et Technologies de Lille

10) 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

9) 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

8) 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
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7) 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

6) 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.
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5) Sophie Soiron, Cyrille Lenain, Luc Aymard, F. Chevallier
Graphite broyé sous hydrogène ou sous oxygène: propriétés électrochimiques

4) Michel Baron, Alain Chamayou, et Alexandre GIL
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3) G. Saint -Ayes , L. Chaffron, G. LeCaër, G. Martin,JJViet, G. André
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2) Raphaël Janot et, Daniel Guérard
sur la synthèse de nanoparticules de maghémite par broyage mécanique

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