RESEAU FRANCAIS DE MECANOSYNTHESE
Lettre N°37

Avril 1998

111 (+1) Groupes de Recherches (dont 47 à l'étranger)

152 (+5) Correspondants

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

5 NOUVELLES ADHESIONS

J.L. Bobet - ICMCB - Bordeaux
A. Fnidiki - Lab. Magn. & Appl. -CNRS URA 808 -Univ. Rouen -Mt St Aignan Cdx3 - France
T. Grosdidier - Université de Metz - France
C. Lemoine - Lab. Magn. & Appl. -CNRS URA 808 -Univ. Rouen-Mt St Aignan Cdx3
M. Nathl - ICMCB - Bordeaux

JRFM98

Le Mans - 12 & 13 Mai 1998

Prière de vous inscrire rapidement afin de faciliter le travail du Comité d'Organisation (N. Randrianantoandro - J.-M. Grenèche- Y. Labaye- G. Silly - E. Gaffet)

Le comité d'organisation a choisi comme thème:

Propriétés Physiques et Chimiques des matériaux nanostructurés

Ci-jointe une fiche de pré-inscription contenant un appel à communication à retourner **avant le 30 avril 1998** au comité d'organisation (Le Mans) des JRFM98. L'inscription à ces Journées est gratuite pour les doctorants accompagnés par un membre du RFM. Les doctorants doivent cependant être membres du RFM (pour des problèmes d'assurance lors des JRFM)

Fiche d'inscription

3èmes Journées du Réseau Français de Mécanosynthèse
Le Mans les 12 &13 mai 1998
à renvoyer avant le 28 février 1998 à

Nirina Randrianantoandro (Journées RFM98), Laboratoire de Physique de l'Etat Condensé (UPRES A 6087 CNRS), UFR Sciences, Université du Maine, Avenue Olivier Messiaen , 72085 Le Mans Cedex 09
Tél : 02.43.83.35.11, Fax: 02.43.83.35.18,
E-mail : Nirina@lola.univ-lemans.fr

Nom : ....Prénom : ....
Adresse :..
....
Téléphone: .... / Fax :....................E_Mail :
Souhaite présenter une communication lors des JRFM98 sous forme de
dune communication orale dun poster
Titre ....
(joindre un résumé dune page maximum, avec le titre et l'adresse complète (tél, e-mail),caractère : Times 12 et marges 25 mm)

Frais d'inscription (+ 2 déjeuners et un dîner):
Etudiant(e) en thèse : gratuit autre : 300 FF
Règlement de l'inscription 1998 au RFM: 100 FF (obligatoire pour tout participant aux JRFM98)
Mode de paiement :
Bon de commande Chèque
Libellé à l'ordre du Réseau Français de Mécanosynthèse.

Laboratoire de Physique de l'Etat Condensé (UPRES A 6087 CNRS), UFR Sciences, Université du Maine, Avenue Olivier Messiaen , 72085 Le Mans Cedex 09 - Fax : 02.43.83.35.18

Liste des Conférenciers Invités (liste provisoire)

[1] Mesures granulométriques
J. Dodds
Ecole des Mines d'Albi
[2] Microstructures et susceptibilité en hyperfréquences de matériaux magnétique
M. Bertin
ONERA Chatillon
[3] Utilisation des techniques de diffusion des neutrons et des rayons X pour étudier les propriétés structurales d'alliages obtenus par mécanosynthèse
N. Cowlam
Université de Sheffield
[4] Amélioration des propriétés mécaniques par nanodispersion d'Al_2O_3 dans l'intermétallique FeAl
F. Thévenot, K. Wolski, J.Le Coze
Ecole des Mines de St Etienne

Propositions de Communications Orales (liste provisoire)

[1] "Comportement à long - terme des alliages nanocristallins Ti2RuFe and Ti2RuFeO2 vis à vis de la réaction de dégagement d'hydrogène dans les conditions d'utilisation de l'industrie des chlorates"
L. Roué, E. Irissou, S. Bouaricha, M. Blouin, D. Guay - INRS Varennes (Québec) - Canada
S. Boily, J. Huot, R. Schulz - Institut Recherche d'HydroQuébec- Québec - Canada
[2] "Propriétés physique et chimiques de composites nanostructurés Al -- AlN
P. Goeuriot, C. Troadec, J. Vicens, J.L. Chermant, P. Verdier, Y. Laurent
ENSME St Etienne, LERMAT Caen, URA 1486 Rennes
[3] "Réactivité des poudres mécaniquement activées : application à la synthèse du type SHS dans les systèmes Fe - Si et Mo - Si"
C. Gras, F. Charlot, E. Gaffet, F. Bernard, J.C. Niepce
L2RS /CNRS Dijon & CNRS / IPSé Belfort

Propositions de Communications par Affiches (liste provisoire)

[1] "Etude par spectrométrie Mössbauer et microscopie électronique à transmission d'alliages Fe - Cr élaborés par mécanosynthèse"
C. Lemoine, A. Fnidiki, D. Lemarchand, J. Teillet
GMP CNRS - Université de Rouen
[2] "Relations Microstructure / Texture / Propriétés de Fe Al obtenu par mécanosynthèse et extrusion"
S. Lenhard, F. Wagner, T. Grosdidier, S. Revol, R. Baccino
CNRS 2090 - Metz et CEA/CEREM Grenoble
[3] "Evolution de la taille des cristallites et du taux de microdéformations au cours du broyage : cas du fer nanométrique"
M. Zouggar, P. Chartier, J. Mimault, M. Grosbras
S2PMI - Université de Poitiers
[4] "Synthèse et caractérisation de l'évolution d'alliages Al Ni Zr hors équilibre"
J.-P. Braganti, O. Held, F.-A. Kuhnast, J.-C. Gachon
UMR CNRS 7555 - Université H. Poincaré - Nancy
[5] "Expansion thermique anormale du Ni nanocristallin obtenu par broyage"
M. Tachikart, Ph. Lesage, C. Meunier, S. Vives, E. Gaffet
LIP/IPSe - CNRS/IPSe Belfort - LMIT Montbéliard
[6] "Influence du mode de broyage pour l'elaboration d'intermétallique FeAl par MASHS"
F. Charlot, E. Gaffet, F. Bernard, J.C. Niepce
L2RS - CNRS Université de Bourgogne - Dijon & CNRS/IPSe Belfort
[7] "Etude de Recuits d'alliages Fe - Cr partiellement mélangés"
T. Ziller, P. Delcroix, G. Le Caër
LSG2M - CNRS/Ecole des Mines - Nancy
[8] "Caractérisation physico - chimique de dioxydes de titane broyés"
T. Girot, S. Begin - Colin, A. Mocellin, G. Le Caër, M.O. Simonnot, J.F. Remy, M. Sardin
LSG2M - CNRS/ Ecole des Mines - Nancy & LSGC/CNRS - Nancy
[9] "Mécanosynthèse de molybdates de lanthanes
Ph. Lacorre, R. Retou, N. Randrianantoandro
Universite du Maine - Le Mans
[10] "Mécanosynthèse du système Fe - F"
H. Guerault
Université du Maine - Le Mans

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ANNONCE DE CONGRES ET / OU ECOLES
CONGRESS AND SCHOOL ANNOUCEMENTS

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All the details may be obtained by E_Mail to E. Gaffet

Journées d'Etudes des Equilibres entre Phases
XXIV JEEP
Nancy - France - 2 et 3 Avril
Contact : JEEP98@ltm.u-nancy.fr

Colloque National de Métallurgie des Poudres
Efets de la microstructure et de la porosié sur les propriétés mécaniques et physiques des matériaux MdP
Grenoble - 6 - 8 Avril 1998 - Org. SF2M

"Recent Advances in Granular Nanostructures and Nanocrystalline Materials
II. - Crystallisation of Amorphous Solids
Grenoble - 22 - 24 Avril 1998
Contact : A.R. Yavari - E_Mail : Yavari@ltpcm.inpg.fr

JRFM 98
Le Mans - France - 12 - 13 Mai 1998
Comité d'organisation : J.-M. Grenèche, Y. Labaye, N. Randrianantoandro, G. Silly, E. Gaffet

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PM2Tec 98
Int. Conf on Powder Metallurgy and Particulate Materials
Las Vegas - USA - 31 Mai 4 Juin 1998
E_Mail : info@mpif.org - WebSite : www.mpif.org

3rd Pacific RIM International Conference on
Advanced Materials and Processing
Honolulu - Hawaï - 12 - 16 Juin 1998
Contact : M. Imam - Naval Research Lab. Washington - E_Mail Imam@anvil.nrl.navy.mil
et R. DeNale NSWC - E_Mail : DeNale@Oasys.dt.Navy.mil

NANO'98
Stockholm - Suède - 14 - 19 Juin 1998
Secrétariat Cof. : nano98@kth.se

Advanced Nanomaterials from Vapor (ANfV'98)
Uppsala - Suède (Satellite Meeting to NANO'98) - 17 Juin 1998
Contact : L. Kiss - Uppsala University / **E_Mail :** Laszlo.Kiss@Material.uu.se

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CIMTEC'98 - World Ceramics Congress and Forum on New Materials
Florence - 14 - 19 Juin 1998
Web Site : http://www.dinamica.it/cimtec98/

3rd International Symposium on Metallic Multilayers (MML'98)
Vancouver - 14 - 19 Juin 1998
Contact : E_MAil : Conference_Service@SFU.CA

E_MRS 1998 - Spring Meeting
Strasbourg - France - 16 - 19 Juin 1998
E_Mail : emrs@phase.c-strasbourg.fr

"High Temperature Nanostrucutured Materials" Session
High Temperature Materials, Processing and Diagnostics Gordon Conference
New Hampshire - 19 - 24 Juin 1998
Contact : J. Gole - Georgia Institute of Technology E_Mail : PH294jg@prism.gatech.edu
et N. Jacobson E_Mail Nathan.S.Jacobson@lerc.Nasa.gov

41ème Colloque de Métallurgie de l'INSTN
"Ségrégation Interfaciale dans les Solides
Saclay - France - 23 - 25 Juin 1997
Contact : J. Pugnetti - Secrétariat 41 ème Colloque INSTN
CEA Saclay - INSTN - 91191 - Gif sur Yvette Cedex - Fax : +33 - (0) 1 - 69 08 97 77

NOUVEAU
NEW

4th Russian Conference on the
Physics and Chemistry of Ultra Dispersed Systems"
Obninsk - Russie - 29 Juin 3 Juillet
Contact : P.N. Martynov E_Mail : Sta@ippe.rssi.ru

Journées Francophones des Jeunes Physico-Chimistes
7-9 juillet 1998 - Montpellier

La 4e édition de ces journées multidisciplinaires propose aux étudiants et jeunes chercheurs un lieu de rencontre et d'échange autour de la Physico-Chimie. Trois grands thèmes seront abordés: - Biologie, Santé, Environnement;
- Matière, Matériaux;
- Réactivité, Surfaces, Interfaces.

Chaque thème sera introduit par une personnalité scientifique, développé par une série de communications orales et complété par une séance de communications par affiche.

Responsables: Josette Olivier-Fourcade, Jean-Claude Jumas, Pierre-Emmanuel Lippens
Renseignements: Pierre-Emmanuel Lippens
Laboratoire de Physicochimie de la Matière Condensée UMR5617 Université Montpellier II - CC003 34095 Montpellier Cedex 05
Tél.: 04 67 14 45 48 / Fax: 04 67 14 42 90 / E-mail : jfjpc@crit.univ-montp2.fr
Internet : http://ubik.crbm.cnrs-mop.fr/jfjpc98/jfjpc-98.html

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High Temperature Nanostructured Materials
Gordon Conference - New Hampshire - USA - 19 - 24 Juillet 1998
Contact : Nanthan.S.Jacobson@lerc.nasa.gov

EuroMAt'98
Lisbonne - Portugal - 22 - 24 Juillet 1998
E_Mail : lfspm@lemac.ist.utl.pt

Intelligent Processing of Nanostructured Ceramics
Materials Science Summer Institute - New Brunswick - 20 - 29 Août 1998
Contact : L.C. Klein Rutgers University - E_Mail ; Licklein@RCI.Rutgers.Edu

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6èmes Journées de la Matière Condensée "JMC6" et 17th General Conference of the Condensed Matter Division of the European Physical Society "CMD17"
Grenoble - France - 25 - 29 Août 1998
Org : Société Française de Physique et European Physical Society
Website : http://www.polycnrs-gre.fr/eps.html

Fatigue Damage of Structural Materials II
Engineering Foundation Conference
Cape Cod - Massachusetts - USA 31 Août - 4 Septembre 1998
Org. A.K. Vasudevan, J.C. Cammett, T. Nicholas, K. Jata
E_Mail : engfnd@aol.com

ESTAC 7 et EUROSOLID - 5
Baltonfüred - 30 Août - 4 Septembre 1998
Contact : Prof. G. Liptay - Hungarian Chemical Society - Fö u. 68, Budapest - H - 1027 Hongrie

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5th International Conference on Nanometer scale Science and Technology (NANO 5)
Birmingham - UK - 31 Aout - 4 Septembre 1998
Site : http:://www.iop.org/IOP/Confs/IVC

Ninth International Symposium on Small Particles and Inorganic Clusters (ISSPIC 9)
Lausanne - Suisse - 1 - 5 Septembre 1998
Website : http:://ipent.epfl.ch/isspic9

Magnetism of Nanostructured Phases - MNP Conference EMMA Satellite Meeting
San Sebastian (Espagne) - 4 / 6 Septembre 1998
E_Mail : wupdocal@sp.ehu.es

9th European Symposium on Comminution and Classification
Albi (France) - 8 - 10 Septembre 1998
sous l'égide de l'European Federation of Chemical Engineering
Contacts : J. Dodds - Chairman of the Organizing Committee

First Joint ESF - NSF Symposium on Aerosols for Nanostructured Materials and Device
Edinburgh - Ecosse - 12 Septembre 1998
Contact : h. Fissan@uni-duisburg.de ou dyhpui@tc.umn.edu

First International Conference on Inorganic Materials
Synthesis, Characterisation, Properties and Applications of Inorganic Materials
Versailles - 16 / 19 Septembre 1998 - France
Website : http://www.elsevier.nl/locate/materials98

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NEW

ISAPM98

3rd International Symposium on Advanced Powder Materials (ISAPM98)
23 - 26 September 1998 - KAIST - Tazejong - Corée du Sud
Correspondence : Prof. Suk-Joong L. Kang or Ms. Sung Sook Park - Center for Interface Science and Engineering of Materials (CISEM) - Korea Advanced Institute of Science and Technology (KAIST) - Yusong-gu, Kusong-dong, Taejon, 305-701 Korea - Tel : 82-(0)42-869-4113, 8919 / Fax : 82-(0)42-869-8920
E-mail : sjkang@sorak.kaist.ac.kr / e_cisem@cais.kaist.ac.kr

Solid State Chemistry : Novel Syntheses and New Materials

Bordeaux - France - 24/26 Septembre 1998
Website : http:://chemistry.rsc.org/rsc/confs.htm

The Rehbinder Memorial International Conference
on Colloïd Chemistry and Physical Chemical Mechanics
Moscou (Russie) - 4 - 8 Octobre 1998
Contact : Prof. N.B. Uriev - Institute of Physical Chemistry - Leninsky Prospect 31 - 11795 Moscow - Russie
E_Mail : Rehbinder98rehb.chem.msu.su ou http://www.chem.msu.su

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Powder Metallurgy 98

Granada - Espagne - 18 - 22 Octobre 1998
Site Web : http://www.epma.com/congress/

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JA 98

Paris - 27 - 29 Octobre 1998
Symposium 1 : Phénomènes déterministes et aléatoires en science des matériaux
Symposium 2 : Matériaux poreux et mousses : élaboration, structures et propriétés
Symposium 3 : Les hydrures métalliques
Symposium 4 : Propriétés Thermophysiques et thermomécaniques des matériaux de la mesure à la simulation de procédés industriels
Symposium 5 : Analyse d'images et reconnaissance de formes en matériaux
Symposium 6 : Lois de comportement et calcul de structures
Org. SF2M - **Contact** : SFMM@wanadoo.fr

Symposium on Advanced Technologies for Particle Production

AIChE Annual Meeting
15 - 20 November - Miami Beach - Fl - USA
Technical Sessions and ChairPersonns
1/ Particle Synthesis in Dispersions and Supercritical Fluids-R. Davis/MT Harris/D. Tomasko
2/ Sol - Gel Synthesis of Particles - A McCormick/PN Kumta/T. Okubo
3/ Chemical Kinetics during Particle Formation - J. Floess, K. Higashitani, S. E. Pratsinis
4/ In-Situ Diagnostics during Particle Formation-Ph. W. Morrison,R.M. Carangelo, D.T. Spicer
5/ Agglomerate Particle Dynamics - G. Fotou, SK Friedlander, Takahashi
6/ Computational Fluid Dynamics during Particle Formation and Growth - L. Collins, K. Kontomaris
7/ Aerosol Reactors - A.W. Weimer, M. Kamal Akhtar
8/ Particle Charging - T. Matsoukas
9/ Film synthesis by Particle Technologies - G. Grader, S. Bhandarkar
10/ Nanoparticles - M. Senna, TJ Mountziaris, H. Glicksmn
11/ Particulate deposits : Transport mechanisms, microstructure and properties : D. Rosner
12/ Posters on Advanced Technologies for Particles Production : G. Beaucage, H. Riemenschneider
Web Site : www.aiche.org

ISMANAM98

International Symposium on Metastable, Mechanically Alloyed and Nanocrystalline Materials
Wollongong (Sydney) - Australie - 7 - 12 Décembre 1998
International Advisory Committee :
V.V. Boldyrev, R.W. Cahn, S. Enzo,H. Fecht, E. Gaffet, A. Garcia - Escorial, A.L. Greer, E.Y. Gutmanas, K. Lu, M. Mammoun, M.T. Mora, H. Mori, M.A. Morris, L. Schultz, M. Senna, A. Slawska - Waniewska, R. Schwarz, R.W. Siegel, M. Umemoto
ISMANAM Steering Committee:
J.H. Ahn, M.D. Baro, A. Calka, S. Gialanella, A. Inoue, G. Le Caer, D.G. Morris, P.H. Shingu, H. Bakker, R. Bormann, G. Cocco, A. Hernando, C.C Koch, M. Magini, R. Schulz, A.R. Yavari
Contact : A. Calka E_Mail : Andrzej_Calka@uow.edu.au et
WebSite : http:://www.uow.edu.au/conferences/ismanam98

Satellite Symposium on Mechanochemistry / ISMANAM98

(Mechanochemical Synthesis and Mechanochemistry)
Wollongong - Australie 7 /12 Decembre 1998
International Advisory Committee :

E. Ivanov (Chairman), A. Calka, V. Bodyrev, P. Butyagin,
E. Gaffet, E. Gutman, M. Senna, C. Suryanaryana, R. Schwarz
WebSite : http:://www.uow.edu.au/conferences/ismanam98

Nanostructured Hybrid Materials
Symposium TMS Annual Meeting - San Diego CA - USA - 28 Février 4 Mars 1999
Contact : gmchow@anvil.nrl.navy.mil

Nanostructured Materials Symposium at the 5th IUMRS International Conference on Advanced Materials (ICAM'99)
Beijing - Chine - 31 Mai - 5 Juin 1999
Contact : Kelu@imr.ac.cn

10th International Conference on Rapidly Quenched and Metastable Materials (RQ10)
Bangalore - Inde - 23 - 27 Août 1999
Wesite : http:://www.metalrg.iisc.ernet.in/rqten/

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Annonces de Soutenance de Thèses

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Effects of the mechanical milling on carbons : negative electrode materials of Li - ion batteries"
F. Salver Disma - Université de Picardie Jules Verne - 4 Février 98
Jury : Aymard L., Beguin F., Coulon M., Furdin G, Lassegues JC, Percheron Guegan A., Rouzaud JN, Tarascon JM.

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"Elaboration et Caractérisations de Cermets Alumine - Métal à partir de poudres obtenues par Mécanosynthèse"
J.-L. Guichard - INPL - Nancy - 23 Janvier 1998
Jury : A. Simon, C. Carry, F. Thévenot, G. Le Caër, A. Mocellin

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"Spinelles nanométriques à valence mixte et à fort taux de lacunes cationiques : Transfert électroniques dans un ferrite de molybdène Fe2.47Mo0.53O4, de la synthèse aux propriétés magnétiques dans le système fer - vanadium $Fe_{3-x}V_xO_4$ (0²x<2).
V. Nivoix - Université de Bourgogne - 17 Décembre 1997
Jury : M. Lenglet, H. Pascard, G. Bertrand, E. Gaffet, M. Guyot, M. Lallemand, A. Rousset, B. Gillot

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"Suivi par Diffraction X en Temps Réel de la Formation par Combustion des intermétalliques des systèmes Al - Ni, Al - Ti, Al - Ni - Ti"
J. F. Javel - Université de Nancy I - 3 Octobre 1997
Jury : J.F. Berar, F. Bernard, M. Bessiere, M. Dirand, J.C. Gachon, P. Galez, J.C. Jorda

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"Contribution à l'Etude de la Transformation - Tribologique Surperficielle en Fretting"
E. Sauger - Ecole Centrale de Lyon - Génie des Matériaux - 26 Septembre 1997
Jury : L. Mora - Ponsonnet, P. Blanchard, K. Dang Van, C. Esnouf, E. Gaffet, E. Rosset, A.B. Vannes, L. Vincent

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"Mechanically induced order-disorder transitions in AlFe"
Thesis by **M. Meyer**, December 1996
presented at Universidad Nacional de La Plata, Argentina - directed by L. Mendoza-Zélis

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Bibliographie Récente

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

Livres ou "Special Issues"

"Mechanical Behaviour of Nanostructured Materials prepared by Mechanical Alloying"
par D.G. Morris Ed. : Materials Science Foundation Series - Trans Tech Publ. (http://www.ttp.ch/ttp_pps.htm)
"Aluminium -Based Metallic Glasses and Nanocrystalline Alloys (Formation, Thermal Stability and Mechanical Properties) - par U. Köster
Ed. : Materials Science Foundation Series - Trans Tech Publications (http://www.ttp.ch/ttp_pps.htm)
"High Strength Bulk Amorphous Alloys with Good Viscous Flowability" - par A. Inoue
Ed. : Materials Science Foundation Series - Trans Tech Publications (http://www.ttp.ch/ttp_pps.htm)
"Miedema' Semi - Empirical Model for estimating Enthalpies in Alloys - par H. Bakker
Ed. : Materials Science Foundation Series - Trans Tech Publications (http://www.ttp.ch/ttp_pps.htm)
"Chemical MechanoSynthesis of Nanomaterials"

The International Journal of Non - Equilibrium Processing - Guest Editor : E. Gaffet - disponible 1998
Editeur : A.L. Greer, Editeurs Associés : M. Atzmon, L. Battezzati, M. Umemoto

"Mécanosynthèse"
Les Annales de Chimie - Science des Matériaux - Coordinateur G. Le Caër (1997) -22(6) (1997) 341 - 433

Les Matériaux à Grains Ultrafins produits par Hypercorroyage"
Les Annales de Chimie - Science des Matériaux - Coordinateur R.Z. Valiev (1997)

Proceeding du Congrès "Mechanically Alloyed and Nanocrystalline Materials" - Rome (1996)
Editor : D. Fiorani, M. Magini - Materials Science Forum - Volumes 235 - 238 (1997)

Proceedings International conference on Nano Clusters and Granular Materials Sendai (1995)
Materials Science & Engineering A-Structural Materials Properties Microstructure & Processing. 217:R 11, 1996

Proceeding du Congrès "Mechanically Alloyed and Nanocrystalline Materials" - Québec (1995)
Editor : R. Schulz - Materials Science Forum - Volumes 225 - 227 (1996))

Proceeding du Congrès "Mechanically Alloyed and Nanocrystalline Materials" - Grenoble (1994)
Editor : A.R. Yavari - Materials Science Forum Volumes 179 - 181 (1995)

"Mechanochemistry of Solid Surfaces"
E.M. Gutman (Ben - Gurion University of the Negev) - World Sci. Pub Co. Pte. Ltd (1994) - ISBN 981-02-1781-1

"Mechanical Properties & Deformation Behavior of Materials having Ultra-fine Microstructures"
Ed. M. Nastasi, D.M. Parkin, H. Gleiter - Nato ASI Series. Ser. E : Appl. Sci. Vol. 233 (1993)

PERIODIQUES (Rubrique assurée en partie grâce au concours de Mme TAUZIN - FIN BiPSé)

[43] FORMATION OF CEO2-ZRO2 SOLID SOLUTION DURING ATTRITION MILLING OF CEO2 POWDER
Suda A. Kandori T. Terao N. Ukyo Y. Sobukawa H. Sugiura M. - J. Materials Science Letters. 17(2):89-90, 1998

[42] EFFECTS OF MECHANICAL GRINDING ON THE HYDROGEN STORAGE PROPERTIES OF LANI5 - OBSERVATION OF THE INTERMEDIATE HYDRIDE LANI5H3 STABILISED BY CO SURFACE TREATMENT
Corre S. Fruchart D. Adachi G. - Journal of Alloys & Compounds. 264(1-2):164-166, 1998
The effects of mechanical grinding on the hydrogen storage properties of LaNi5 were investigated. Ground powders were once hydrogenated. and then the resulting hydride was stabilised with a CO surface treatment to slow down the desorption kinetic of the hydride. It was found that the ball milling provokes the formation of the intermediate phase LaNi5Hx with x approximate to 3, whereas this phase was nor found for activated unground LaNi5 powders. P-C-T measurements performed at room temperature with unactivated ground LaNi5 powder do not reveal the presence of LaNi5H3 at desorption, showing that this phase appears only when the desorption kinetic of the hydride is slow.

[41] STRUCTURAL AND MAGNETIC PROPERTIES OF MECHANICALLY ALLOYED ND14FE76M3C7 (M=SI, CU, AL, CO, TI, NB, GA) ALLOYS
Sui YC. Zhang ZD. Liu W. Xiao QF. Zhao XG. Zhao T. Chuang YC. - J. All. Comp.. 264(1-2):228-231, 1998
Structure, phase transformation and magnetic properties of mechanically alloyed (MA) samples of Nd14Fe76M3C7 (M=Si, Al, Cu, Co, Ti, Nb, Ga) have been studied systematically. Compared with tile original samples, the various transitional metal substitutions ciecrrase the thermal stability of the 2-14-1 tetragonal hard magnetic phase. Substitution of Cu, Nb, Ga and Ti harms the formation of hard magnetic phases while substitution of Si,Al and Co substitution does not. Cobalt substitution decreases both the coercivity and the remanence of Nd-2(Fe,Co)(14) C-based alloys. Si substituted Nd-Fe-C has the best magnetic properties in this series, with M-1=6.16 kG, H-i(c)=5.65 kOe and (BH)(max)=6.8 MGOe. Al substitution increases the coercivity slightly.

[40] PHASE FORMATION AND MAGNETIC PROPERTIES OF ANNEALED MECHANICAL ALLOYING ND-FE-V-TI ALLOYS AND THEIR NITRIDES
Tang SL. Wu CH. Jin XM. Wang BW. Li GS. Ding BZ. Chuang YC. - J. All. & Comp. 264(1-2):240-243, 1998
Phase formation in annealed mechanical alloyed NdFe10.5+x V1.5(1-x) Ti-x and magnetic properties of the consequent phases and their nitrides were investigated by using X-ray diffraction and magnetic measurement. From the X-rap diffraction patterns we have constructed a phase formation diagram as a function of Ti content x and annealing temperature. The demarcation curve between 1:7 and 1:12 phases moves to higher annealing temperatures with increasing Ti content. In the NdFe11 Ti alloy the ThMn12 structure is obtained by annealing the as-milled powder at temperatures above 950 degrees C. The nitrides NdFe10.5+0.5x V1.5(1-x) TixNy retain the same structure as their parent compounds. The nitride with high V content is more stable than that with low V content. Upon nitrogenation, the Curie temperature is enhanced from 150 degrees C to 180 degrees C. In NdFe10.5+0.5x V1.5(1-x) TixNyTc the values fall in the range 450-480 degrees C. The hard magnetic properties of NdFe10.5+0.5x V1.5(1-x) TixNy magnets have been assessed.

[39] DEVELOPMENT OF NANOCRYSTALLINE AL-TI ALLOY POWDERS BY REACTIVE BALL MILLING
Moon KI. Lee KS. - Journal of Alloys & Compounds. 264(1-2):258-266, 1998
Elemental powders of Al and Ti were mechanically alloyed in a hydrogen atmosphere to produce nanocrystalline Al-Ti alloys. A brittle hydride phase(TiH)(2) was formed and well dispersed by a solid-gas reaction during initial milling. The particle size was effectively reduced by the formation of TiH2 and the grain size in the particles became nanoscale with progression of the milling. High resolution transmission electron spectroscopy (HREM) analysis showed the presence of TiH2 at the boundaries of Al or Al-3 Ti grains. This phase is considered to not only reduce the particle size but also to impede the grain growth during the heat treatment. Decomposition of TiH2 and subsequent formation of Al3Ti occurred at 440-480 degrees C. However, the heat treated powders maintained their nano-sized structure.

[38] STRUCTURE AND PROPERTIES OF BULK NANO-STRUCTURED WC-CO ALLOY BY MECHANICAL ALLOYING

Xueming MA. Gang JI. Ling Z. Yuanda D. - Journal of Alloys & Compounds. 264(1-2):267-270, 1998
Mixtures of elemental powders of nominal composition WC-6wt% Co and WC-6wt% Co-1wt% VC were prepared using 99.5% purity tungsten, graphite, cobalt and vanadium powders with particle sizes smaller than 75 mu m. Mechanical alloying (MA) was performed in a QM-1 planetary ball mill. The structural evolution and the crystallite size changes of the powders during MA were monitored by X-ray diffraction. The results show that cemented carbides of WC-Co powder with crystalline sizes of about 10 nm were directly synthesized from elemental powders by mechanical alloying. Cold compacting was carried our at a pressure of 800 MPa using a manual uniaxial press with carbide insert dies. The hardness and sintered density of sintered samples were measured. The effects of small VC additions on the grain size, density and hardness of sintered samples were also investigated.

[37] MICROSTRUCTURAL AND THERMAL INVESTIGATIONS OF IRON-SILICON NANOCOMPOSITE MATERIALS SYNTHESISED BY ROD MILLING

Abdellaoui M. - Journal of Alloys & Compounds. 264(1-2):285-292, 1998
Based on X-ray diffraction (XRD) investigations and thermal analysis assisted by differential scanning calorimetry (DSC), the far from equilibrium phase transitions induced by conventional or modified horizontal rod mills, when starting from a mixture of Fe and Si elementary powders in, respectively, 81.9 and 18.1 atomic fractions (Fe+18.1 Si at.%), were studied. The analyses of the XRD patterns as well as the DSC curves reveal that the rod milled end products are nanocomposite materials formed by a mixture of a disordered nanocrystalline A2 phase, an amorphous phase and some traces of non-reacted Si powders. It has been concluded that for both the crystalline to amorphous phase transition and the Si atom dissolution in the A2 solid solution, the rod milling becomes more effective when the cylinder rotation speed approaches an optimal value and when using an adequate number of rods (i.e. when using 170 rpm cylinder rotation speed and two rods). A partial crystallisation of the amorphous phase and a partial precipitation of the dissolved Si atoms are observed to occur for higher injected shock power values (i.e. when using 3 rods and 170 rpm cylinder rotation speed)

[36] SYNTHESIS BY MECHANICAL ALLOYING AND THERMOELECTRIC PROPERTIES OF CU2TE

Sridhar K. Chattopadhyay K. - Journal of Alloys & Compounds. 264(1-2):293-298, 1998
Hexagonal Cu-2 Te has been synthesised by mechanical alloying from elemental powders. The milling time required for the synthesis is longer than that reported for other tellurides. The mechanical grinding of the bulk Cu2Te obtained by the melting route does not change the structure. Prolonged milling as well as grinding beyond 40 h lead to a decrease in grain size to nanometer level. The cold compaction of milled or ground powders exhibit much smaller Seebeck coefficient (thermopower). However, cold compaction of samples milled for longer time (>150 h) lead to the thermopower values close to that of the bulk indicating significant improvement of rheological properties at room temperature for powders milled for long times.

[35] AN INVESTIGATION OF THE EFFECT OF POWDER ON THE IMPACT CHARACTERISTICS BETWEEN A BALL AND A PLATE USING FREE FALLING EXPERIMENTS

Huang H. Dallimore MP. Pan J. Mccormick PG. - Materials Science & Eng. A- 241(1-2):38-47, 1998
The study of the mechanisms of mechanical alloying requires knowledge of the impact characteristics between the ball and vial in the presence of milling powders. In this paper, foe falling experiments have br cn used to investigate the characteristics of impact events involved in mechanical milling. The effects of milling conditions, including impact velocity, ball size and powder thickness. on the coefficient of restitution and impact force are studied. It is found that the powder has a significant influence on the impact process due to its porous structure. This effect can be demonstrated using a modified Kelvin model. This study also confirms that the impact force is a relevant parameter for characterising the impact event due to its sensitivity to the milling conditions.

[34] CONSOLIDATION OF MA AMORPHOUS NITI POWDERS BY SPARK PLASMA SINTERING

Ye LL. Liu ZG. Raviprasad K. Quan MX. Umemoto M. Hu ZQ. - Mater. Sci. Eng. A- 241(1-2):290-293, 1998
Spark plasma sintering, as a recent innovation in rapid powder consolidation was used to sinter amorphous NiTi alloy obtained from mechanical alloying. Densified samples with Ni3Ti, NiTi and NiTi, phases were produced. The grain sizes were retained to within 500 nm at the sintering temperature of 900 degrees C and 1 mu m for the sintering temperature of 1100 degrees C. Based on the results of SEM and TEM, it is found that the formation of crystalline structure is controlled by solid state reaction when the sample was sintered at 900 degrees C, but in the sample compacted at 1100 degrees C, liquid was introduced for the low melting point phase NiTi2 melt. The products after sintering associated with the advantage of spark plasma sintering and the property of amorphous NiTi alloys after mechanical alloying is discussed.

[33] PROCESSING AND RESPONSE OF ALUMINUM-LITHIUM ALLOY COMPOSITES REINFORCED WITH COPPER-COATED SILICON CARBIDE PARTICULATES

Khor KA. Cao Y. Boey FYC. Hanada K. Murakoshi Y. Sudarshan TS. Srivatsan TS. - Journal of Materials Engineering & Performance. 7(1):66-70, 1998
Lithium-containing aluminum alloys have shown promise for demanding aerospace applications because of their light weight, high strength, and good damage tolerance characteristics. additions of ceramic reinforcements to an aluminum-lithium alloy tan significantly enhance specific strength, and specific modulus while concurrently offering acceptable performance at elevated temperatures, The processing and fabrication of aluminum-lithium alloy-based composites are hampered by particulate agglomeration or clustering and the existence of poor interfacial relationships between the reinforcing phase and the matrix, The problem of distribution of the reinforcing phase in the metal matrix can be alleviated by mechanical alloying, This article presents the results of a study aimed at addressing and improving the interfacial relationship between the host matrix and the reinforcing phase, Copper-coated silicon carbide particulates are introduced as the particulate reinforcing phase, and the resultant composite mixture is processed by conventional milling followed by hot pressing and hot extrusion, The influence of extrusion ratio and extrusion temperature on microstructure and mechanical properties was established, Post extrusion processing by hot isostatic pressing was also examined, Results reveal the increase in elastic modulus of the aluminum-lithium alloy

matrix reinforced with copper-coated SLC to be significantly more than the mechanically alloyed Al-Li/SiC counterpart, This suggests the possible contributions of interfacial strengthening on mechanical response in direct comparison with a uniform distribution of the reinforcing ceramic particulates.

[32] THE EFFECT OF HEATING AND QUENCHING ON GRINDING CHARACTERISTICS OF QUARTZITE

Pocock J. Veasey TJ. Tavares LM. King RP. **-** Powder Technology. 95(2):137-142, 1998

The effect of heating quartzite from room temperature to 650 degrees C in 1 h then quenching in various aqueous media has been investigated by two different methods. Operating work index tests were used to determine the effect of this process on the grinding energy required for size reduction of the material over an hour of milling. Ultra-fast load cell (UFLC) tests were carried out to determine the effect of the process on the specific fracture energy E and the particle strength sigma(p) of the material prior to milling. The UFLC tests showed that the aqueous media quenches caused a significant reduction in both E and sigma(p), compared with the untreated material; acid, alkali and salt solution quenches caused further reductions in these values compared with water-only quenching. The operating work index tests showed that aqueous quenching reduced the grinding energy required for the first 30 min of milling, and this effect was still noticeable after 60 min of milling in the case of acid, alkali and salt solution quenches. The two independent test procedures have established the effectiveness of this process for weakening quartzite.

[31] CRYSTALLOGRAPHIC AND MAGNETIC PROPERTIES OF R3FE29-XVXN4 (R = Y, CE, ND, SM, GD, TB, AND DY)

Han XF. Yang FM. Li QS. Zhang MC. Zhou SZ. **-** Journal of Physics-Condensed Matter.10(1):151-163, 1998

A systematic investigation of crystallographic and magnetic properties of nitride R3Fe29-xVxN4 (R = Y, Ce, Nd, Sm, Gd, Tb, and Dy) has been performed. Nitrogenation leads to a relative volume expansion of about 6%. The lattice constants and unit cell volume decrease with increasing rare-earth atomic number from Nd to Dy, reflecting the lanthanide contraction. On average, the Curie temperature increases due to the nitrogenation to about 200 K compared with its parent compound. Generally speaking, nitrogenation also results in a remarkable improvement of the saturation magnetization and anisotropy fields at 4.2 K and room temperature for R3Fe29-xVxN4 compared with their parent compounds. The transition temperature indicates the spin reorientations of R3Fe29-xVxN4 for R = Nd and Sm are at around 375 and 370 K which are higher than that of R3Fe29-xVx, for R = Nd and Sm 145 and 140 K, respectively. The magnetohistory effects of R3Fe29-xVxN4 (R = Ce, Nd, and Sm) are observed in low fields of 0.04 T. After nitrogenation the easy magnetization direction of Sm3Fe26.7V2.3 is changed from an easy-cone structure to the b-axis. As a preliminary result, a maximum remanence B-r of 0.94 T, an intrinsic coercivity mu(0)H(C) of 0.75 T, and a maximum energy product (B H)(max) of 108.5 kJ m(-3) for the nitride magnet Sm3Fe26.7V2.3N4 are achieved by ball-milling at 293 K.

[30] MECHANICAL GRINDING OF PRECURSOR POWDER AND ITS EFFECT ON THE MICROSTRUCTURE AND CRITICAL CURRENT DENSITY OF AG/BI-2223 TAPES

Kim WJ. Kwon SC. Lee HJ. Lee HG. Hong GW. Kuk IH. **-** Physica C. 294(1-2):147-155, 1998

The effects of the particle size of precursor powder on the microstructure and critical current density, J(c), of Ag-Sheathed Bi-2223 tapes were investigated. The calcined powder with a nominal composition of Bi1.89Pb0.41Sr2.01Ca2.23Cu3.03Oy was milled for various times using a planetary ball mill. The transport property of the tapes was found to depend strongly on the particle size of the precursor powder. Enhanced reactivity of the milled powder facilitated the formation of 2223 phase and resulted in an increase of J(c). Excessive milling, however, led to the amorphization of the powder. The heavily deformed powder was decomposed into 2201 and second phases during degassing treatment, which retarded the transformation of 2223 phase and hence significantly degraded the electrical property of the tapes.

[29] SILANE CROSSLINKING OF PLASTICIZED POLY(VINYL CHLORIDE

Fiaz M. Gilbert M. **-** Advances in Polymer Technology. 17(1):37-51, 1998

In this study the use of three different types of aminosilanes for crosslinking plasticized PVC was investigated. The processing techniques used were milling, followed by press molding and extrusion. The processing conditions were carefully adjusted to minimize premature crosslinking. Crosslinking was carried out by immersing the samples in hot water for 4 h. Gel content was determined by Soxhlet extraction in tetrahydrofuran. Tensile properties were measured at room temperature and at 100 degrees C or 130 degrees C. Bis(gamma-trimethoxysilylpropyl)amine was found to be the best of the three silanes investigated for crosslinking plasticized PVC, enabling adequate gel content to be obtained to improve the properties at elevated temperature, while avoiding premature crosslinking. Compounds stabilized with either tin or Ba/Zn possessed adequate thermal stability at 190 degrees C. No changes were seen in the tensile properties at room temperature, but significant improvements were obtained at 100 degrees/130 degrees C. Results obtained using thermomechanical analysis showed increased penetration resistance with increase in gel content.

[28] AMORPHIZATION OF ZR-AL-NI-CU DURING COLD ROLLING OF ELEMENTAL FOILS AT AMBIENT TEMPERATURES

Sagel A. Sieber H. Fecht HJ. Perepezko JH. **-** Philosophical Magazine Letters. 77(2):109-115, 1998

Amorphous samples of a multicomponent Zr-Al-Ni-Cu alloy have been synthesized at ambient temperature from a layered array of individual elemental sheets by repeated low-strain-rate cold rolling with intermediate folding. The alloying reactions during cold rolling were monitored with electron and X-ray diffraction and thermal analysis. During the initial stage of processing a dissolution of solute into Zr together viith a reduction in grain size to about 30 nm was observed and with further processing a fully amorphous sample was obtained after 120 deformation cycles. The characteristics of the amorphous phase developed by repeated cold deformation indicate that it is compositionally homogeneous, structurally relaxed and without the typical impurity levels obtained by mechanical alloying.

[27] SOLID STATE REACTIONS INDUCED BY BALL MILLING

Takacs L. **-** Hyperfine Interactions. 111(1-4):245-250, 1998

Ball milling can be used to induce solid state reactions in a variety of technologies, including the activation of silicates, inorganic synthesis, and mechanical alloying. Mossbauer spectroscopy is a powerful tool to study these processes. Some typical examples are discussed in this paper, concerning disordering, alloying, and simple chemical reactions. Many more industrial applications are possible, with ample opportunity for meaningful Mossbauer investigations.

[26] NANOSTRUCTURED Y-FE ALLOYS PRODUCED BY BALL MILLING

Venskutonis A. Aubertin F. Breme J. - Hyperfine Interactions. 112(1-4):161-164, 1998.

Ball milling was used to produce nanostructured Y-Fe alloys. Depending on preparation conditions, nanocrystalline and amorphous components are formed to coexist. The transmission Mossbauer spectra exhibit YFe2 and amorphous components. The influence of superparamagnetic YFe2 particles was separated from the amorphous part by measuring at 77 K. The thermal stability of the samples and the growth of equilibrium phases was studied by annealing.

[25] BARIUM FERRITE BALL MILLED IN VACUUM

Campbell SJ. Wu E. Kaczmarek WA. Wang G. - Hyperfine Interactions. 112(1-4):243-246, 1998

The structural and magnetic behaviour of BaFe12O19 subjected to milling in vacuum for 1000 h has been investigated by x-ray powder diffraction and Mossbauer effect spectroscopy techniques. Pronounced structural disorder is obtained along with partial decomposition of BaFe12O19 to alpha-Fe2O3 and evidence for superparamagnetic relaxation effects due to the fine particles produced on milling. Restoration of the fully crystallised BaFe12O19 structure on annealing at 1000 degrees C is accompanied by a six fold enhancement in the magnetic coercivity. This behaviour is linked with the fine crystallites.

[24] MECHANOCHEMICAL TRANSFORMATIONS IN THE ZINC-MAGNETITE SYSTEM

Takacs L. Reno RC. Pardavihorvath M. - Hyperfine Interactions. 112(1-4):247-250, 1998.

Mixtures of magnetite and zinc powders were milled for up to 540 minutes and the development of the system was followed using X-ray diffraction, Mossbauer spectroscopy, and magnetic measurements. The process takes place in two overlapping steps. During the first hour of milling, a nonmagnetic intermediate mixed oxide phase forms which decomposes into ZnO and Fe upon further milling. The freshly formed iron particles are supersaturated with Zn.

[23] SWIFT AMORPHIZATION OF A SUPERSATURATED TITANIUM SOLUTION BY MECHANICAL MILLING

Li DJ. Akerman AJ. Doherty KJ. Poon SJ. Shiflet GJ. - Scripta Materialia. 38(4):603-609, 1998

[22] PROCESSING, STRUCTURE AND PROPERTIES OF NI-W ALLOYS FABRICATED BY MECHANICAL ALLOYING AND HOT-ISOSTATIC PRESSING

Mi S. Courtney TH. - Scripta Materialia. 38(4):637-644, 1998

[21] CONSOLIDATION OF MAGNETIC POWDERS BY SHOCK COMPRESSION

Kaszuwara W. Leonowicz M. Januszewski D. Mendoza G. Davies HA. Paszula J. - Journal of Materials Science-Materials in Electronics. 9(1):17-23, 1998

The application of shock consolidation of powder precursors using explosives for the processing of bulk permanent magnet materials was studied. Powders of Sm-Fe-N and Nd-Fe-B produced by milling of ingot material, mechanical alloying, hydrogenation-disproportionation-desorption and recombination (HDDR), or by pulverizing of melt-spun ribbon were pressed at a shock wave speed of 1200 m s(-1) and pressures up to 4.4 GPa. It was found that consolidation of the hard magnetic powders could be achieved without changes of the phase structure and grain size and that the resulting bulk magnets had high coercivities and remanences. The final density depended on the composition of the material and on the initial grain size. The shock processing method was found to be particularly appropriate for the consolidation of nanostructured materials for which excessive grain growth during consolidation must be avoided.

[20] PROCESSING OF MULLITE CERAMIC FROM ALKOXIDE-DERIVED SILICA AND COLLOIDAL ALUMINA WITH ULTRA-HIGH COLD ISOSTATIC PRESSING

Cho YI. Kamiya H. Suzuki Y. Horio M. Suzuki H. - J. European Ceramic Society. 18(3):261-268, 1998

Ultra-fine mullite precursor powders were prepared from the uniform mixtures of ultra-fine gamma-Al2O3 and alkoxide-derived SiO2 powders. Two kinds of mixing methods-ball milling and stirring-were used to change the level of mixing. The ball milling method attained the more uniform mixing state to form single phase mullite after the calcination of mixed powder at 1300 degrees C. Green compacts of the calcined precursor powders were consolidated by ultra-high cold isostatic pressing up to I GPa. Since ultra-high isostatic pressure offers the close packing structure in the green compacts, the maximum relative density of the green compacts reached about 60% of theoretical in which the inter-aggregate pore was collapsed to reduced the pore size below 6 nm. These closely and uniformly packed green compacts could be sintered almost full density of a stoichiometric mullite ceramic without glassy and other crystalline phase. Maximum density of the compacts reached more than 96% of theoretical by the pressureless sintering even below liquid formation temperature. As a result, dense mullite ceramic with a stoichiometric composition and fine microstructure composed of grains below 0.5 mu m could be sintered at relatively low temperatures.

[19] SYNTHESIS AND CHARACTERIZATION OF ND2FE14B-25 VOL PERCENT FE NANOCOMPOSITE MAGNETS

Raviprasad K. Funakoshi M. Umemoto M. - Journal of Applied Physics. 83(2):921-929, 1998

Synthesis of nanocomposite two-phase permanent magnet materials by mechanical milling requires optimization of the volume fractions of the two phases, milling time, heat treatment temperature, and time. In the present study, optimization of milling time, heat treatment temperature, and time have been carried out by fixing, respectively, the volume fractions of hard and soft phases at 75 and 25. Prior to the synthesis of nanocomposite magnets, the effect of milling on the magnetic properties of the hard phase was studied. The results on milling of hard phase have shown the lower and upper limits of milling time to be 108 and 144 ks, respectively. Milling for 144 ks and heat treatment at 823 K for 1.8 ks was found to result in nanocomposite magnets with the best properties. The microstructural characterization has shown clearly that when the heat treatment temperature is higher, grain growth takes place and consequently the magnetic properties of the nanocomposites deteriorate. Compositional analysis using transmission electron microscopy has shown grains richer in Fe and Nd. The rationalization of magnetic properties shows that to improve the energy product, coercivity needs to be improved. Alloying addition of Cr and Cu was found to improve coercivity and consequently the energy product. Finally, it was shown that by using finer Fe particles one can reduce the time required for milling and avoid many adverse effects resulting from long time milling.

[18] HIGH STRAIN RATE SUPERPLASTIC FLOW STRESS AND POST-DEFORMATION MECHANICAL PROPERTIES OF MECHANICALLY ALLOYED 2024 ALUMINIUM ALLOY REINFORCED WITH SIC PARTICLES

Matsuki K. Kawakami H. Tokizawa M. Murakami S. - Mat. Sci. & Technology. 13(12):1039-1044, 1997

Composites consisting of 2024 aluminium alloys reinforced with volume fractions of 0, 5, 10, and 15 vol.-% of SiC particles were fabricated from the mechanically alloyed powders by an optimised hot compactions and prestraining process. Fine and equiaxed grain structures with grain sizes of <1 mu m were observed within the matrix of each alloy. The composite specimens were compressed at temperatures between 733 and 813 K with a wide strain range from 10(-3) to 10 s(-1). Two strain rate regions with different slopes from similar to 5 x 10(-1) s(-1) were found in log (true stress)-log (strain rate) curves. In the lower strain rate region of each alloy, the strain rate sensitivity values m were 0.03-0.16. The threshold stress sigma(th) for each alloy was estimated using an extrapolation procedure. A linear relationship was found between V-f(0.5) and sigma(th) where V-f is the volume fraction of SiC particles. In the higher stain rate region of each alloy, m values greater than 0.3 were obtained at 773 K, which is very close to the solidus temperature of 775 K for 2024 aluminium alloy. Moreover, the maximum yield strength and elongation for each alloy at room temperature were also obtained in the specimens compressed at 773 K. Thus, it was found that the optimum temperature for the high strain rate superplastic processing of the specimens compressed at 773 K. Thus, it was found that the optimum temperature for the high stain rate superplastic processing of the composites was just below the solidus temperature of the 2024 aluminium alloy. The grain coarsening resulted in the decrease of post-deformation strength and ductility as well as the m value in hot compression above the solidus temperature.

[17] RECOVERY OF MOLYBDENUM AND COBALT POWDERS FROM SPENT HYDROGENATION CATALYST

Rabah MA. Hewaidy IF. Farghaly FE. - Powder Metallurgy. 40(4):283-288, 1997

Free powders as well as compacts of molybdenum and cobalt have been successfully recovered from spent hydrogenation and desulphurisation catalysts. A mixture of concentrated sulphuric and nitric acids (3 : 1 by volume) achieved adequate levels of recovery of both metals, which increased with increase in acid concentration, time (up to 3h), and temperature (100 degrees C), and with decrease in particle diameter of the spent catalyst. The process how sheet involved crushing, milling, particle sizing, acid leaching, and roasting of the obtained hydroxides in an atmospheric oxygen to obtain the respective oxides. These were reduced under a constant mass flowrate of hydrogen gas at 1100 and 900 degrees C respectively. Parameters affecting the properties of the products and the recovery efficiency value, such as acid concentration, particle diameter of the solid catalyst, temperature, and time, have been investigated. The results obtained showed that the maximum recovery efficiency amounted to 96%. The recovered metal powders are technically pure, meeting the standard specifications. Compact shapes of molybdenum acquired density values which increased with an increase of the pressing load, whereby a density value of 2280 kg m(-3) is attained at greater than or equal to 0.75 MPa. A model explaining the obtained results assumes that the molybdenum and cobalt in the spent catalyst are supported by the carrier. During operation, carbon particles are deposited and poison the catalyst. The weight ratio of carbon increases as the particle size of the catalyst decreases. Nitric acid helps dissolution of these metals to form complex sulphate salts. High oxide states of molybdenum and cobalt are formed by roasting in atmospheric oxygen. Reduction with hydrogen gas takes place in two steps, the overall activation energy of which amounts to 144.39 kJ mol(-1) for molybdenum and 143.4 kJ mol(-1) for cobalt. The metal powders have a rough surface with an irregular shape. Densification of these powders by pressing takes place as a result of random movement of the metal particles. Above a critical load, the minimum void volume is achieved at which the interparticle friction resists the applied load. A study has revealed that spent catalyst contains molybdenum and cobalt that are economically recoverable. Cost of recovery and the process of recovery is simple.

[16] RAPIDLY SOLIDIFIED NEODYMIA-STABILISED ZIRCONIA COATINGS PREPARED BY DC PLASMA SPRAYING

Khor KA. Yang J. - Surface & Coatings Technology. 96(2-3):313-322, 1997

Stabilisation of the phases in zirconia alloys is pivotal in their applications as advanced structural ceramics. Stress-induced transformation toughening is dependent on the characteristics of the metastable tetragonal zirconia phase. Rare-earth oxides are known to stabilise the cubic and tetragonal phases. This paper presents the preparation of neodymia-stabilised zirconia powders and their coatings by plasma spraying. The amount of neodymia ranged from 2 mol.% to 10 mol.%. The feedstock for plasma-sprayed coatings was prepared by a combination of mechanical milling and thermal plasma melt and solidification processes. Phase analysis of the plasma rapidly solidified powders and plasma-sprayed coatings was determined through X-ray diffraction (XRD). Results show that the phases in the plasma-sprayed coatings have better stability than the plasma-spheroidised powders, and demonstrates the efficacy of "double melting" in achieving enforced solid solution of the tetragonal phase and chemical homogeneity in the rapidly solidified material. The tetragonal phase is stabilised when 2 to 7 mol.% neodymia is added. There is evidence that suggests the formation of an enforced solid solution of the tetragonal phase in the compositional range 4-7 mol.% Nd,O-2(3).,. This extended solid solution series was found to be rather unstable upon heating and the t-->m transformation was observed during cooling. Transformation to the cubic phase occurred after heat treatment at 1400 degrees C for 10 h. However, at 8 mol.% and 10 mol.% neodymia (as-sprayed coatings) the cubic phase is stabilised. Heat treatment at high temperature (1400 degrees C) showed that there could be some amounts of the non-transformable t' phase. The amount of monoclinic phase in the coatings is lower than in the feedstock powder, suggesting that further stabilisation of the tetragonal phase (which reflected better chemical homogeneity) is achievable with plasma-spray deposition.

[15] VERIFICATION OF SANDELIN PHENOMENA IN MECHANICALLY ALLOYED FE-ZN AND FE-ZN-SI

Jordan AD. Uwakweh ONC. Materials Transactions Jim. 38(12):1100-1105, 1997
Mechanical alloying through the ball-milling of elemental powders to form the zinc-rich zeta binary Fe-Zn alloy, and the ternaries consisting of 0.12 mass%Si, 1.2 mass%Si, and 2.4 mass%Si, based on the same Fe/Zn ratio was performed. These materials have been designated as zeta, zeta + 0.12 mass%Si, zeta + 1.2 mass%Si, and zeta + 2.4 mass%Si and mechanically alloyed to form their metastable states, eta-Zn, FeSi and zeta phases. Differential scanning calorimetry (DSC) measurements of the materials show the presence of characteristic exothermic and endothermic reactions during their continuous transformation to stable equilibrium states. In the zeta + 0.12 mass%Si material composition (i.e., Sandelin region), wt: observe an invariant reaction peak at around 422 degrees C, corresponding to both the eutectic reaction in the Zn-Si and the melting of Zn in the Fe-Zn systems. The observation of the FeSi phase for all the compositions, while absent in coatings of Si bearing steels suggests a relationship between the Sandelin effect and its formation.

[14] EVALUATION OF METHODS TO PRODUCE TOUGH CR3SI BASED COMPOSITES

Cruse TA. Newkirk JW. - Materials Science & Engineering A-240:410-418, 1997
Several methods of improving the toughness of Cr-Cr3Si composites produced by powder metallurgy have been examined. Mechanical alloying of Cr-3.92 w/o with 0.5 w/o V showed the best improvement in toughness of this phase. Replacing Cr3Si with a (Cr-0.57, Mo-0.43)(3)Si, produced in situ from a mechanically alloyed powder, offered a slight improvement in toughness. By combining these phases a composite was produced with a toughness greater than 10 MPa m(-2). Other second phase materials were also examined for providing second phase toughening of Cr3Si. These include an Fe-Al alloy, Ni3Al + B, and 304L stainless steel. At the level of 25 v/o these materials at present do not appear to offer much improvement in toughness. Cr-Cr,Si composites were hot forged to produce a more layered microstructure and refine the microstructure of are-melted samples. The layered microstructure should be tougher, but has not been tested yet.

[13] MECHANICAL PROPERTIES OF NIAL-ALN-AL2O3 COMPOSITES

Choo H. Nash P. Dollar M. - Materials Science & Engineering A-240:464-471, 1997
The mechanical properties of NiAl-based composites containing a dispersion of AIN particles and Al2O3 fibers were studied. NiAl matrix powder containing a dispersion of about 5 vol.% AlN was synthesized by mechanical alloying (MA) of elemental nickel and aluminum under a nitrogen gas atmosphere. Nextel 610 short fibers were used as the second reinforcement in the composite. Composites containing 5, 15 and 30 vol.% of the Al2O3 fibers in addition to the AIN dispersion particles were fabricated by hot pressing a dry blend of the MA NiAl powder and the fibers. The as-fabricated microstructures revealed that the matrix is fully dense and bonded well with the randomly distributed Al2O3, fibers. Neither chemical reaction nor cracks were observed at the fiber/matrix interface. Compressive behavior of the composites and a monolithic counterpart was studied at 1300 K and strain rates between 8.5 x 10(-4) and 2.8 x 10(-6) s(-1). The 0.2% yield stress of the composites increases with fiber volume fraction at all strain rates. The strain rate-flow stress behavior at 1300 K indicates that the strength of NiAl-5%AIN-30%Al2O3 approaches that of NASAIR 100, a first generation Ni-base single crystal superalloy.

[12] SYNTHESIS AND CHARACTERIZATION OF MECHANICALLY ALLOYED NB3AL-BASE ALLOYS

Dymek S. Dollar M. Leonard K. - Materials Science & Engineering A-240:507-514, 1997
Two Nb-Al alloys containing 18 and 20 at.%Al were successfully processed by mechanical alloying followed by hot pressing. Analysis of X-ray spectra as well as transmission electron microscopy studies revealed the presence of four phases: niobium solid solution (Nb-ss), Nb3Al, Nb2Al and dispersoids of Al2O3. The grain size was estimated to be approximately 1 mu m. Nb-ss grains contained a very high dislocation density while a high density of planar stacking faults was observed in the intermetallic phases. The alloys exhibited only limited compressive ductility at room temperature but were ductile at 1000 degrees C. The mechanism for creep deformation in the examined Nb-Al alloys is postulated to be dislocation creep through diffusion controlled climb. The compressive strength was higher and creep rates were lower in the present materials compared to reference NiAl-based materials processed and consolidated using the same techniques.

[11] REACTION SYNTHESIS OF REFRACTORY DISILICIDES BY MECHANICAL ALLOYING AND SHOCK REACTIVE SYNTHESIS TECHNIQUES

Yen BK. Aizawa T. Kihara J. Sakakibara N. - Materials Science & Engineering A-240:515-521, 1997
The reaction synthesis of disilicides of Group IVA-VIA transition metals by mechanical alloying and shock reactive synthesis techniques has been investigated. All nine disilicide compounds were directly produced from their elemental powder mixtures by mechanical alloying. Moreover, the formation of some disilicides, such as MoSi2 and NbSi2, proceeded by mechanically induced self-propagating reactions, the mechanism of which is analogous to that of the self-propagating high-temperature synthesis (SHS). Shock reactive synthesis of MoSi2, NbSi2, and TiSi2 was conducted with a one-stage gun. Powder samples used for the shock study were prepared from metal-silicon powder mixtures that had been subjected to high-energy ball milling. The explosive driven flyer plate struck the sample-containing capsule at a velocity of 1 km s(-1). In most cases, shock-induced reactions went to completion. The effect of thermochemical driving force on the reactive formation of the disilicide compounds is discussed.

[10] FABRICATION OF NI-SHEATHED NICKEL ALUMINIDE WIRES FROM MECHANICALLY ALLOYED PRECURSORS

Aizawa T. Kihara J. - Materials Science & Engineering A.240:522-531, 1997
Cold working by swaging and shape-rolling of mechanically alloyed compact is proposed to fabricate the composite wires. The bulk mechanical alloying is useful here to produce a sufficient amount of homogeneously refined mixture of nickel and aluminum in bulk. Through heat treatment at 873 K for 10 h, Ni-sheathed green wires can be converted to a composite wire of nickel aluminides. Since mechanical alloyed powder compact is used as a starting material for fabrication of composite wires, regularization reaction into nickel aluminides can be ignited at relatively low temperatures. The bulk mechanical alloying is used to yield the refined elemental mixture without any formation of intermetallic compounds, so that sufficient workability should be preserved for the subsequent wiring process. The

present method is supposed to be promising to make near-net shaping of nickel aluminides. Warm extrusion method is also utilized in this method instead of heat treatment.

[9] NANOSTRUCTURE FORMATION AND PROPERTIES OF BALL-MILLED NIAL INTERMETALLIC COMPOUND

Eckert J. Borner I. - Materials Science & Engineering A - 240:619-624, 1997

Binary Ni(x)A1(100-x) (46 less than or equal to x less than or equal to 60) compounds with ordered B2 structure were prepared by mechanical attrition of are-melted compounds. The average grain size of the as-milled powders (5-12 nm), the rms atomic-level strain, the stored enthalpy and the microhardness depend on the composition of the material. Varying the composition within the homogeneity range of the B2 phase field by adding elemental Ni and Al and subsequent mechanical alloying changes the grain size reversibly. Hence, the grain size depends on the intrinsic properties of the material. The results will be discussed with respect to models for the evolution of nanocrystalline grain sizes during milling based on the underlying mechanisms of plastic deformation and recovery for stoichiometric and off-stoichiometric compositions.

[8] FORMATION OF ODS LL(2)-(AL,CR)(3)TI BY MECHANICAL ALLOYING

Heilmaier M. Saage H. Eckert J. - Materials Science & Engineering A- 240:652-657, 1997

Recently, it has been shown that the addition of a certain amount of ternary alloying elements like Cr transforms the tetragonal DO22-structure of A1(3)Ti to the cubic L1(2)-structure with higher crystal symmetry. However, this attempt of overcoming its brittleness at ambient temperature results in relatively poor creep strength at high temperatures. Therefore, the methods of mechanical alloying and high energy ball milling were used to prepare the ternary (A1,Cr)(3)Ti L1(2)-intermetallic compound additionally strengthened by small volume fractions of incoherent Y2O3 dispersoids. The development of the microstructure and the phase formation were investigated by X-ray diffraction and transmission electron microscopy (TEM). First results on consolidated bulk samples are presented, indicating the possibility of producing oxide dispersion strengthened (ODS) intermetallics from mechanically milled powders.

[7] MICROSTRUCTURE OF NB-AL POWDERS CONSOLIDATED BY SPARK PLASMA SINTERING PROCESS

Murakami T. Kitahara A. Koga Y. Kawahara M. Inui H. Yamaguchi M. - Mat. Sci. & Eng. A- 240:672-679, 1997

Mechanically alloyed and blended Nb-A1, Nb-A1-W, Nb-A1-Mo and Nb-A1-N powders were sintered by a spark plasma sintering process and the microstructure and mechanical properties of compacts were investigated. Fully-densed Nb-A1 compacts are obtained when sintering temperature is higher than 1773 K, although the microstructure of compacts consolidated from blended elemental powders is much coarser than that of compacts consolidated from mechanically alloyed powders. The microstructure of Nb-A1-W and Nb-Al-Mo compacts was not homogeneous, probably because of insufficient sintering time. Nb-AI compacts, in which the Nb2N phase is dispersed, was found to be prepared by sintering blended Nb and A1N powders by the spark plasma sintering process.

[6] CONTRIBUTIONN TO THE STUDY OF THE MECHANISM OF CORROSION OF NANOCRYSTALLINE NICKEL COATING OBTAINED BY BALL MILLING

O. El Kedim, E. Gaffet - Eur. Feder.Corr. N°20 - Ed. L. Fedrizzi, P.L. Bonora - Proc. EuroCorr'96 (1997) ., 267 - 275

The electrochemical behaviour in various electrolytes of nanocrystalline Ni coatings obtained by ball milling was investigated by potentiodynamic test methods and compared with that of polycrystalline Ni. The results are discussed and the passivation mechanism is proposed. Nanocrystalline materials are polycrystalline materials with grain size of up to about 100 nm. Because of the extremely small dimensions, a large fraction of the atoms in these materials is located at the grain boundaries, and this confers special attributes.

[5] ALN DISPERSED REINFORCED ALUMINUM COMPOSITE

Troadec C. Goeuriot P. Verdier P. Laurent Y. Vicens J. Boitier G. Chermant JL. Mordike BL.- J. European Ceramic Society. 17(15-16):1867-1875, 1997

In this paper the first results are presented on nitriding of aluminium powder and the fabrication of Al-AlN composites after milling and hot-pressing. Nitriding appears to follow a complex process. High energetic milling of these powders is an important factor in obtaining homogeneous materials with AlN nanometric grains. TEM and EDX nanoanalyses have shown that Al grains are surrounded by AlN nanocrystals, with some Al2O3 needles and AlON crystals. Physical properties - thermal expansion, thermal conductivity, electrical conductivity, hardness, Young's modulus, fracture strength - of these composites change with the AlN content, and the values for 0 vol.% AlN (process powders) always correspond to higher or lower values than for pure Al (unprocessed powders), reflecting the fact that processing introduces impurities. A comparison of composites fabricated from composite powders and fr om a mixture of Al-AlN commercially available powders is interesting. Generally these new composites exhibit better properties than those for Al-SiC or Al-Al2O3 composites with an apparently similar reinforcement content.

[4] MECHANOCHEMICAL REACTIONS OF ILMENITE WITH DIFFERENT ADDITIVES

Chen Y. Williams JS. Ninham B. - Colloids & Surfaces A-Physicochemical & Eng. Aspects. 130:61-66, 1997

Different mechanochemical reactions between ilmenite (FeTiO3) and elemental powders have been observed during high-energy ball milling, where the ilmenite has been reduced to crystalline iron, nanocrystalline oxides and amorphous phases at room temperature. The processes of the mechanochemical reactions were investigated by X-ray diffraction analysis and differential thermal analysis. The observed mechanochemical reactions seem to occur under high-energy ball impacts and are different from the corresponding thermally activated reactions.

[3] A HIGH TEMPERATURE X-RAY DIFFRACTION STUDY OF THE CRYSTALLISATION OF AMORPHOUS BALL-MILLED ZIRCON

Puclin T. Kaczmarek WA. - Colloids & Surfaces A-Physicochemical & Engineering Aspects. 130:365-375, 1997

The crystallisation pathways for zircon and other oxide mixtures which had been ball milled were examined by high temperature powder X-ray diffraction. Zircon, zircon-alumina and zirconia-silica mixtures were partially or completely amorphised by prolonged milling. Upon heating, full recrystallisation of zircon as a nanocrystalline phase was observed before rapid grain growth occurred. Crystallisation was found to occur by heterogeneous nucleation with simultaneous slow grain growth by coalescence. Zirconia-silica and zircon-alumina milled mixtures also formed a transient tetragonal zirconia phase during heating, which reacted with silica to form zircon. The zirconia-silica system in particular crystallised zircon at a significantly lower temperature than reported previously for other solid-state preparation techniques.

[2] FORMATION OF ND2FE14B HYDRIDE BY MILLING OF ANHYDRIDE PARTICLES IN TOLUENE IN A CLOSED REACTOR

Ram S. Banerjee HD. Haldar S. Ramachandrarao P. - Bulletin of Materials Science. 20(8):1049-1058, 1997

When milling micrometer thin Nd2Fe14B platelets, of an average 1-2 mm diameter, in toluene in a closed reactor, part of the toluene decomposes at the surface of the platelets and yields nascent hydrogen and carbon/low hydrocarbons. The hydrogen diffuses into the Nd,Fe,,B platelets and the carbon forms a thin surface passivation layer of the platelets, forming the stable Nd2Fe14BHx, x less than or equal to 5, hydride at room temperature. On heating in a calorimeter, the hydrogen desorbs off the sample with a well-defined endotherm between 370 and 425 K. An N-2 gas atmosphere, if used during the heating, facilitates the H-desorption process with the modified kinetic parameters. For example, the enthalpy of the H-desorption Delta H and the related activation energy E-a have the measured values Delta H=153J/g and E-a = 58.2 kJ/mol in argon and Delta H = 256 J/g and E-a = 41.6 kJ/mol in N-2. It is argued that N-2 gas has a fast reaction with the H atoms desorbing off the thin sample platelets and forms NH3 gas with an instantaneous decrease of the total external gas pressure at the sample. This supports the fast desorption of H atoms in the sample with the modified desorption kinetics in N-2 gas.

[1] EFFECT OF THE MANUFACTURING TECHNOLOGY ON THE STRUCTURE AND PROPERTIES OF HEAT-TREATABLE POWDER STEELS

Maslennikov NN. Bobrova SN. Grevnov LM. Bekker VY. - Met Science & Heat Treatment. 39(7-8):343-346, 1997

High-energy disintegration of powder charges (the method of mechanical alloying) in which the initial components interact at a higher substructural level than in conventional mixing provides qualitatively new powder materials with a high degree of homogeneity and dispersity of the structure. The possibilities of the given method for a radical improvement of the quality of low-alloy heat-treatable steels virtually have not been studied because of the absence of data on the special features of polymorphic transformations in mechanically alloyed powder materials based on iron. This hampers realization of the advantages of powder metallurgy over other less efficient technologies in the field of manufacturing high-strength structural parts. In order to substantiate the choice of heat-treatment regimes of mechanically alloyed materials, the authors of the present paper studied the special features of the isothermal gamma --> alpha transformation and the structure and properties of low-alloy steels after sintering and heat treatment.

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Site sur la cristallographie / Soft + Littérature

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

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• N. Feninèche (1997)	**Laboratoire de ThermoMécanique** - IPSé - F90010 - Belfort Cedex
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• J. Foct (1997)	**Lab. de Métallurgie Physique** Univ. Lille 1 - Bat C6 - 2ème Et. -F59655 - Villenuve d'ascq
• J. - O. Fourcade (1997)	**LPMS - CNRS D0407** - Univ. Montpellier II - Sci. et Techn. du Languedoc Place E. Bataillon - F34095 - Montpellier Cedex 5
• D. Fruchart (1998)	**Lab. de Cristallographie** -UPR CNRS 5031 - BP 166 - F38042 - Grenoble Cedex
• J. - C. Gachon (1998)	**Lab. Thermodyn. Mét.** - URA CNRS 158 - Univ. Nancy I - B.P. 239-54506-Vandoeuvre Cdx
• E. Gaffet (1997)	**CNRS UPR 423** "Elab. et Transitions de Phases Hors Equilibre"-IPSé -F90010 - Belfort Cedex
• J.-P. Ganne (1997)	**Lab. Central de Recherches** - Thomson CSF Domaine de Corbeville - F91404 - Orsay
• P -F. Gobin*	**INSA de Lyon** - Bat. 502 - Lab. Physique des Matériaux - F69621 - Villeurbanne Cedex
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• D. Guerard (1997)	**Lab. Chimie du Sol. Minéral - CNRS** - B.P. 239 - Vandoeuvre les Nancy Cedex
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• B. Guilhot*	ENSMSE -**Lab. Physicochimie Matériaux** -158 Cours Fauriel - F42023 St Etienne Cdx
• V. Hays*	**Lab. de Génie des Matériaux** - ISITEM - CP3023 - F44087 - Nantes cedex 03
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• F.A. Kuhnast (1997)	LCSM - URA CNRS 158 - Univ. H. Poincaré - Nancy I - F54506 Vandoeuvre Cedex
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• M. Latroche	**LCMSTR - CNRS** - 1 Place A. Briand - F92195 - Meudon Cedex
• G. Le Caër (1998)	**LSG2M- CNRS** - Ecole des Mines - F54042 - Nancy Cedex
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• C. Lemoine (1998)	**Lab. Magn. & Appl.** -URA 808 -Univ. Rouen-UFR Sci.& Tech-F76821 - Mt St Aignan Cdx3
• C Levaillant*	**Centre Matériaux** - Ecole Mines d'Albi Carmaux - Rue de la Poudriére-F81013 - Albi Cedex 09
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• C. Massobrio (1997)	**IPCMS - Groupe Etude Matériaux Métal.** - 23 Rue du Loess - F67037 - Strasbourg Cedex
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• F. Nardou (1997)	**LMCTS** - Eq. "Céramiques Nouvelles" - 123 Avenue Albert Thomas - F87060 - Limoges Cedex
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G. Nicolas (1997)	**CIME Bocuze SA** - BP 301 - St Pierre en Faucigny - F74807 - La Roche / Foron Cedex
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• S. Revol (1997)	**CENG- CEREM** - 17 Rue des Martyrs - F38054 - Grenoble Cedex 9
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M. Stamm (1997)	**C2M Technology -** C.E.E.I Zone Industrielle Ste Agathe - Rue Lavoisier- F57192 - Florange
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• H. Szwarc (1998)	Lab. Chimie Phys. Mat. Am. - CNRS URAD1104 - Bat. 490 - Univ. Paris Sud - Orsay F91405
• J. Teillet (1998)	**Lab. Magn. & Appl.** -URA 808 -Univ. Rouen-UFR Sci.& Tech-F76821 - Mt St Aignan Cdx3
• F. Thévenot (1998)	**ENSMSE** - Lab. Céramiques Spéciales - 158 Cours Fauriel - F42023 - Saint Etienne Cedex
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• I. Tkatchenko (1997)	**CNRS/ Institut Recherche Catalyse -** 2 Avenue A. Einstein -F69626 Villeurbanne Cedex
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A. Venot (1997)	**SINTERTECH -** Centre R & D- Voie des Collines - F38800 Le Pont de Claix - France
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