RESEAU FRANCAIS DE MECANOSYNTHESE
Lettre N°13

Avril 1996

50 Laboratoires - 69 (+1) Correspondants

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

1 AN DEJA

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Bulletin d'adhésion 1996

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à le 199

(Signature)

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ANNONCE DE CONGRES ET / OU ECOLES

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3rd International Workshop on Metastable Phases

"Amorphous and Nanocrystalline Materials, Theoritical Aspects, Industrial and Technological Transfer"

Bologna - 9 - 11 Avril 1996

Contact : G. Valdre

Dpt of Physics, Bologna University - Electron Microscopy Centre - Via Irnerio 46 - I - 40126 Bologna - Italie

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METALS CLUSTERS IN CHEMISTRY

Mont St Odile - 2 / 7 Mai 1996

Org. A. Simon, M. Mingos (European Research Conferences)

Contact : Dr. J. Hendekovic, - European Science Foundation - 1 Quai Lezay - Marnésia - 67080 Strasbourg Cdx
Tél : 88 - 76 - 71 - 35 : Fax : 88 - 36 - 69 - 87 : E_Mail : Euresco@esf.org ou http://www.esf.org

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ISMANAM - 96

International Symposium on Metastable Mechanically Alloyed and Nanocrystalline Materials
Rome, Italie - 20 / 24 Mai 1996
Org. : D. Fiorani (CNR Rome), M. Magini (ENEA, Rome)
Secrétariat : S. Coccia(ENEA) - ENEA - C.R. Casaccia, Via Anguillarese 301 - 00060 Rome - Italie
Tél : +39 - 6 30483256 (+39-6-30483391) - Fax : +39-6-30483327 (+39-6-30484928)

ISN'T it ?

International Symposium on Nitrides
St Malo - 29 / 31 Mai 1996
Contact : Prof. P. Verdier-U.R.A. "Verres et Céramiques"-Univ. Rennes I - Av. Général Leclerc - 35042 Rennes Cdx

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Nanomaterials Design, preparation, characterization and applications
Bâle - 30 - 31 Mai 1996
Contact : Technomic Publishing AG, Missionstrasse, 44 - 4055 Basel - Suisse - Tel. : 613815226 Fax : (5259)

Nano 96

Third International Conference on Nanostructured Materials
Kona Coat - Hawaï - Juin 1996

PM^{2}TEC 96

1996 World Congress on Powder Metallurgy & Particulate Materials
Washington - 16 / 21 Juin 1996
Contact : Metal Powder Industr. Fed. - APMI Intern. - 105 College Road East - Princeton, New Jersey 08540 U.S.A.

5th Int. Conf on "Structures under shock and Impact"

International Centre for Mechanical Sciences - 3 - 5 Juillet 1996
Org. : N. Jones, A. Watson - Udine

RQ9

9th Int. Conf. on Rapidly Quenched and Metastable Materials
Bratislava - 25 / 30 Août 1996
Contact : P. Duhaj, P. Mrafko, P. Svec
RQ9 - Institute of Physics - Slovak Academmy of Sciences - Dubravska cesta 9 - 842 28 Bratislava - Slovaquie
Tél. : (00) 42 7 3782193, 3782760 - Fax (00) 42 7 376085 - E_Mail : fyzirq9@savba.sk

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GALERNE 96

"Nouvelles Méthodes de Synthèse pour de Nouveaux Matériaux"
Contact : Marc Henri, E_Mail : Henry@chimie.u-strasbg.fr
et Sylvie Begin (Galerne 96) LSG2M URA 159 CNRS - Ecole des Mines - Parc de Saurupt - 54042 - Nancy Cedex
Tél: 83 - 58 - 42 - 32, Fax : 83 - 57 - 97 - 94

The eight International Symposium on Physics of Materials

Hangzhou - Chine - 16 / 19 Octobre 1996
Contact : Li, Zongquan
Dept of Materials, Science and Engineering - Zhejiang University, Yugu Road 20 310027 Hangzhou, P.R. China
Fax : 0571 - 7951358 E-Mail : mse_xjwu@´zunet.ihep.ac.cn

FGM'96

4th International Symposium on Functionnally Graded Materials -
Tsukuba - 21 / 24 Octobre 1996
Contact : The Society for Non - Traditional Technology : E_Mail : snttmito@po.iijnet.or.jp

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2nd International Conference on Mechanochemistry and Mechanical Activation (INCOME - 2)
Novosibirsk - Russie - 12 - 16 Aout 1997
Contact : Prof. N. Lyakhov - Institute of Solid State Chemistry - Kutateladze 18 - Novosibirsk 630128 - Russie
E_Mail : Conf@solid.nsk.su - Fax : 7 (383) - 2) 32 28 47 - Tel. 7 (383 - 2)32 86 83

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AVIS DE SOUTENANCE DE THESES

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KIENTZ M.O. - Université de Nancy -**12 Septembre 1996**
Jury : J. Foct, B. Malaman, L. Fournes, G. Le Caër, E. Gaffet, A. R. Yavari (à confirmer)

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RAPPEL DES SOUTENANCES DE THESES PRECEDENTES

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S. Renaud - Ecole Centrale de Paris -**13 Décembre 1995**
"Elaboration de poudres Ti_2Be_{17}, Al - Be et Al - Be - Ti par mécanosynthèse et étude préliminaire de leur consolidation"
Jury : Y. Barbaux, D. François, J.B. Guillot, G. Le Caër, F. Moret, F. Ravel

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La liste des thèses précédentes et leur résumés peut être obtenue en écrivant à E. Gaffet

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Bibliographie Récente

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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 :

"Mechanical Properties and 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) - ISBN 0-7923-2195-2
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 Universtity of the Negev) - World Sci. Pub Co. Pte. Ltd (1994) - ISBN 981-02-1781-1

Thèses Etrangères (disponible sur demande auprès de E. Gaffet)
"Microstructure and phase transformation in mechanically alloyed materials" (En Anglais)
J.Y. - Huang - Lab. Atomic Imaging of Solids - Shenyang - Chine
Systèmes Etudiés : Cu, Co, Fe - Cu, Ti - Ni - C

Périodiques (Cette rubrique est assurée depuis un an grâce à Mme TAUZIN - FIN BiPSé)

"Production of iron aluminides by co - rolling of elemental foils followed by heat treatment"
J.R. Blackford, R.A. Buckley, H. Jones, C.M. Sellars - Scripta Materiala, 34(5) (1996) 721 - 728
"Influence of precipitation chemistry and ball-milling on the thermal behavior of zirconium hydroxide"
G Stefanic, S Music, A Sekulic - Thermochimica Acta 273 (FEB 1 1996), 119-133
Zirconium hydroxide precipitates, obtained by rapid precipitation at pH 2.5, 7.5, and 10.5, were ball- milled for up to 60 h and then heated inside a differential scanning calorimeter (DSC) at temperatures of up to 600 degrees C. Crystal phases produced after heating were analyzed by FTIR and laser Raman spectroscopy. It was found that without regard to the precipitation pH the first stage of ball-milling caused an increase of the crystallization temperature that resulted in the formation of pure t-ZrO2. The second stage of ball- milling caused a decrease of the crystallization temperature resulting in the formation of m-ZrO2. The ball-milling process also influenced the dependence of the crystallization enthalpy of zirconium hydroxide on the precipitation pH. In the case of zirconium hydroxide precipitated at pH 2.5, the ball-milling caused dehydration and an increase in its hygroscopy. The nature of these effects was discussed. The extension of FTIR spectra to the far infrared region made it possible to distinguish between t-ZrO2 and m-ZrO2 polymorphs by this technique. Also, the influence of laser power on the identification of ZrO2 polymorphs by Raman spectroscopy was elaborated.
"Induced magnetic anisotropy in Fe80B20 metallic glass by mechanical milling"
GJ Fan, MX Quan, ZQ Hu - Applied Physics Letters 68: 8 (FEB 19 1996), 1159-1161
By means of transmission Mossbauer spectroscopy, the effect of mechanical milling on the magnetic anisotropy of Fe80B20 metallic glass has been studied. On the basis of variation of the areal ratio R(21) of the second to the first Mossbauer line with milling time, it was found that a rotation of the average magnetic-moment directions from the in-plane to an out-of-plane orientation may take place by mechanical milling without onset of bulk crystallization, and that the distribution of the magnetic-moment directions becomes random after the bulk crystallization has occurred. The induced out-of-plane magnetic anisotropy by mechanical milling can be attributed to the occurrence of the chemical short-range order and surface crystallization in the Fe80B20 metallic glass. The latter effect may cause the formation of compressive stresses in the bulk and therefore a rotation of magnetic-moment directions in the Fe80B20 metallic glass.
"Crystallization of a Fe36Ni36B28 metallic glass during ball-milling"
Y Birol, Scripta Materialia 34: 7 (APR 1 1996), 1081-1085
"Metastable iron nitrides by mechanical alloying"
K Odonnell, XL Rao, G Laird, JMD Coey - Physica Status Solidi A - Applied Research 153: 1 (JAN 16 1996) , 223-231
Mechanical alloying of iron nitrides, epsilon-Fe_3N and gamma'-Fe4N together with alpha-Fe has been carried out in an attempt to produce the metastable alpha "-$Fe_{16}N_2$, phase. The distribution of nitrogen in as-milled and annealed materials is determined by Mossbauer spectroscopy. The distinctive feature in the Mossbauer spectrum of alpha "-$Fe_{16}N_2$, the hyperfine component with B-hf = 40 T attributed to Fe in 4d sites which are furthermost from nitrogen is not seen in any of the Mossbauer spectra. The as-milled product is nanocrystalline alpha-Fe with an amorphous

intergranular phase of approximate composition $Fe_{80}N_{20}$. The magnetization of samples decreased on milling and returned to the starting values after annealing which recovers the equilibrium starting mixtures. In the case of the Fe_3N + Fe experiments, annealing produced some Fe_4N together with Fe_3N and Fe.

"Effect of size factor and electron concentration on the degree of supersaturation of copper-based solid solutions prepared by mechanical alloying"

TF Grigoreva, AP Barinova, VV Boldyrev - Inorganic Materials 32: 1 (JAN 1996), 33-35

"Hydrogen absorption of Mg-based composites prepared by mechanical milling: Factors affecting its characteristics"

H Imamura, N Sakasai, Y Kajii - Journal of Alloys and Compounds 232: 1-2 (JAN 1 1996) 218-223

Hydriding and dehydriding properties of Mg-based composites (Mg-G and Mg-Pd-G) which are prepared by mechanical milling of magnesium powder and graphite (G) or graphite supporting 5 wt.% Pd (5 wt.% Pd-G) in the presence of various additives (tetrahydrofuran, benzene or cyclohexane) have been studied. Such composites were effective as hydrogen storage materials even under mild reaction conditions (500 Torr, 453 K). Factors affecting the hydriding characteristics of the composites were extensively investigated in connection with the preparative conditions (additives and their amounts, milling times, Mg:G component ratios, etc.). In particular, the presence of tetrahydrofuran in the milling process strongly affected the hydriding and dehydriding kinetics of the resulting composites. The active composites for hydrogen storage are those in which finely divided magnesium is in intimate contact with graphite. It is expected that their activity results from certain synergetic interactions between Mg and aromatic carbon atoms of graphite containing charge transfer to some extent.

"Metastable phase formation during mechanical alloying of Al-Ge and Al-Si alloys

Journal of Alloys and Compounds 232: 1-2 (JAN 1 1996) - 224-231

In this paper we report the mechanical alloying behaviour of elemental aluminium with diamond cubic elements Ge and Si. A metastable crystalline phase with rhombohedral crystal structure forms in Al-70 Ge-30 and Al-60 Ge-40 alloy compositions. The phase always coexists with elemental constituents and decomposes over a broad temperature range. No such metastable phase could be observed in the Al-Si system. We also report X-ray diffractometry and differential scanning calorimetry results suggestive of amorphization. Finally a comparison was made of the present result with that obtained in rapid solidification.

"Synthesis of amorphous Nd15Fe77B8 alloy powders by mechanical alloying"

T Harada, T Kuji - Journal of Alloys and Compounds 232: 1-2 (JAN 1 1996) - 238-243

Elemental Nd, Fe and B powders were mechanically alloyed using a high-energy ball mill under an argon atmosphere. The change in the structure and the magnetic properties were examined. X-Ray diffraction and differential scanning calorimetry combined with transmission electron microscopic studies revealed that powders milled for 100 h were mainly in the amorphous state. The amorphization by mechanical alloying is attributed to the energy accumulated during the mechanical alloying. The thermal stability of the amorphous materials produced by mechanical alloying was comparable to that of the amorphous materials produced by rapid solidification processing. Heat treatment of the amorphous powders above the crystallization temperature resulted in the formation of ferromagnetic $Nd_2Fe_{14}B$ phase and showed excellent hard magnetic properties, as is the case for the amorphous Nd-Fe-B materials produced by the rapid solidification processing.

"Determination of titanium solubility in alpha- aluminum during high energy milling"

GH Kim, HS Kim, DW Kum - Scripta Materialia 34: 3 (FEB 1 1996), 421-428

"Introduction to the viewpoint set on: Mechanical alloying"

RB Schwarz - Scripta Materialia 34: 1 (JAN 1 1996), 1-4

"Process modeling of the mechanics of mechanical alloying"

TH Courtney, D Maurice - Scripta Materialia 34: 1 (JAN 1 1996), 5-11

"Ball milling: An experimental support to the energy transfer evaluated by the collision model"

M Magini, A Iasonna, F Padella - Scripta Materialia 34: 1 (JAN 1 1996), 13-19

"Amorphization of single composition powders by mechanical milling"

CC Koch, Scripta Materialia 34: 1 (JAN 1 1996), 21-27

"Atomic disorder and amorphization of B2-structure CoZr by ball milling"

GF Zhou, H Bakker - Scripta Materialia 34: 1 (JAN 1 1996), 29-35

"Mechanical alloying to produce L1(2) phases in the Al- Zr system"

PB Desch, RB Schwarz, P Nash - Scripta Materialia 34: 1 (JAN 1 1996), 37-43

"Milling of intermetallics and attempts at their ductilisation"

DG Morris, MA Morris, Scripta Materialia 34: 1 (JAN 1 1996), 45-51

" The morphological evolution of hollow shells during the mechanical milling of ductile metals"

AM Harris, GB Schaffer, NW Page - Scripta Materialia 34: 1 (JAN 1 1996), 67-73

"Mechanisms of powder milling investigated by x-ray diffraction and quantitative metallography"

WM Kuschke, RM Keller, P Grahle, R Mason, E Arzt, Zeitschrift Fur Metallkunde 86: 12 (DEC 1995)

The powder milling (or "mechanical alloying") process was investigated by milling pure Fe, single- phase $Fe_{60}Al_{40}$ and Ni_3Al powders with two different mills. To characterize the process, coherence lengths and rms-strains, using X-ray peak broadening analysis, and the shape factor and size of powder particles, using quantitative metallography, were measured. From the temporal evolution of these quantities it was concluded that the milling process can be subdivided into three periods. In the first period only plastic deformation occurs, followed by fracture of deformed particles. The second period is characterized by the onset of welding and a decrease in the amount of plastic deformation. The third, final and longest period is dominated by an equilibrium of fracture and welding mechanisms, whereas plastic deformation plays only a minor role. The time scale and the path leading to the final microstructure of the powders is shown to depend on the type of the mill utilized.

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N.B. : Dans la perspective de la rédaction du prochain N° de la Lettre du Réseau Français de Mécanosynthèse, tout(e) article, annonce, thèse ... peut être envoyé(e) à Eric Gaffet - CNRS UPR A0423 - Groupe "Elaboration et Transitions de Phases Hors Equilibre" - Institut Polytechnique de Sévenans - F90010 Belfort Cedex Tél. : 84 - 58 - 31 - 02 / Fax : 84 - 58 - 30 - 27 ou par E-mail