

[環境材料工学科]

[区 分 A]

志賀 信哉

材料工学科におけるものづくりプロセスを取り入れた技術者教育への取り組み

松英達也^{*1}、志賀信哉^{*1}、平澤英之^{*1}、日野孝紀^{*1}、大内忠司^{*2}、吉良 真^{*2}

^{*1}新居浜工業高等専門学校環境材料工学科、^{*2}新居浜工業高等専門学校ものづくり教育支援センター技術室

平成 22 年度高専教育講演論文集、331 頁-334 頁 (2010).

材料工学科におけるものづくり教育の取り組みについて、本学科 4 学年で実施している「総合実習」について報告する。総合実習は材料工学科における機械工作実習であり、製品開発における設計から製作、検査、評価までを一貫して行うことで問題解決能力とコミュニケーション能力の育成を図っている。また、学生の要望により CAD 実習を、担当者の意見から作業時の安全対策として巡回指導を取り入れるなど絶えず改善活動を行っている。学生の評価は実習ノートを基本とし、逐次、担当教員が記載内容のチェックを行い、コメントなどを記入して指導を行っている。

松英 達也

RESIDUAL STRESSES OF Cr-N FILMS DEPOSITED BY ARC ION PLATING INVESTIGATED USING SYNCHROTRON RADIATION

T. MATSUE^{*1}, T. HANABUSA^{*2}, K. KUSAKA^{*2}, O. SAKATA^{*3}, M. NISHIDA^{*4}

^{*1}Niihama National College of Technology, ^{*2}School of Eng., The Univ. of Tokushima,
^{*3}Japan Synchrotron Radiation Research Institute, ^{*4}Kobe City College of Technology
Materials Science Forum, Vol. 652, pp. 296-302 (2010).

The structures of Cr-N films deposited by arc ion plating on steel substrates were investigated using a synchrotron radiation system that emits ultraintense X-rays. The Cr-N films were found to be mainly composed of {110} oriented CrN crystals, but they also had a small component of randomly oriented Cr₂N crystals. The CrN₂₂₀ diffraction shifts to a high diffraction angle as the annealing temperature increases. In contrast, the peak position of the Cr₂N₂₁₁ diffraction hardly changes with an increase in the annealing temperature up to 873 K. The ratio of nitrogen and oxygen to chromium at the film surface and inside in the film was estimated by Auger electron spectroscopy. After annealing at 973 K, the surface layer was oxidized, but the composition inside the Cr-N films (N/Cr = 0.83) remained unchanged. The residual stress in a 1600-nm-thick as-deposited CrN layer was found to be -11.0 GPa. The residual stresses of Cr-N films relaxed to thermal stress levels on annealing. However, the residual stress in the Cr₂N layer could not be evaluated.

松英 達也

Stress Estimation of Titanium Casting Alloy by X-ray Measurement Technique of Single Crystal

Masayuki NISHIDA^{*1}, Takao HANABUSA^{*2}, Ayumi SHIRO^{*3} and Tatsuya MATSUE^{*4}

^{*1}Kobe City College of Technology, ^{*2}School of Eng., The Univ. of Tokushima,

^{*3}Graduate Student, School of Eng., The Univ. of Tokushima, ^{*4}Niihama National College of Technology

Materials Science Forum, Vol. 652, pp. 143-148 (2010).

Residual stresses in titanium casting alloy were estimated by X-ray stress measurement technique. There are two problems in the condition of X-ray stress measurement. Firstly, the titanium casting alloy has the large crystal grains. These coarse grains were generated under solidification processes and those sizes are approximately 2 millimeter in this study. These coarse crystal grains interfere with an accurate stress measurement due to the unstable diffraction profile. This is because the existence of a sufficient number of isotropic crystal grains in the X-ray irradiation area are based on the X-ray diffraction theory. In this study, the stress measurement technique of single crystal materials was adopted for the solution of this fundamental problem. Because the coarse crystal grain was treated as a single crystal, the high intensity diffraction profiles were observed from a certain direction with investigations of crystal orientation. The problem with the coarse crystal grain in titanium casting alloy were cleaned up by the employment of the single crystal measurement technique. Secondly, the results from this study show that the position of crystal grain within the X-ray irradiation area greatly influenced the residual stress values. Therefore, in the present paper the erasing method of this position effect was tried and discussed. Finally, the improvement of the accuracy of this method for the residual stress measurement in titanium casting alloy under the several bending stresses was confirmed. These results show that the erasing method in this study is an effective correction method.

松英 達也

Neutron Stress Measurement of Coarse Crystal Grain in Aluminum Casting Alloy

Masayuki NISHIDA^{*1}, Takao HANABUSA^{*2}, Tatsuya MATSUE^{*3} and Hiroshi SUZUKI^{*4}

^{*1}Kobe City College of Technology, ^{*2}School of Eng., The Univ. of Tokushima

^{*3}Niihama National College of Technology, ^{*4}Japan Atomic Energy Agency

• Materials Science Forum, Vol. 652, pp. 243-248 (2010).

Internal stresses in aluminum casting alloy were measured by the neutron stress measurement method with the apparatus RESA in Japan Atomic Energy Agency (JAEA). In usual cases, coarse crystal grains are included in aluminum casting alloy. These coarse crystal grains make it extremely difficult to estimate the internal stresses by the neutron diffraction. The two problems arise because of the existence of the coarse crystal grains. The first problem is the production of an unstable diffraction profile in the necessary direction. The second is the edge effect which is generated by the overhang of the coarse crystal grains from the neutron irradiation area (gage volume). In this study, two kinds of new techniques used were proposed to resolve these problems. Firstly, the elastic theory based on the $\sin^2 \psi$ method is shown. Diffraction peaks in several directions were found by use of the rocking curve method. Following that, the lattice spaces in each principal direction were calculated from these diffraction peaks using the elastic theory. Secondly, the distribution of edge effect around the gage volume was measured using a small bit of copper single crystal. From this result, the edge effect was canceled out by the modified measurement method which was done symmetrically. Finally, the aluminum casting sample which included coarse crystal grains

was set to the tensile testing machine on RESA' s measurement table and the applicability of these new techniques were confirmed experimentally.

松英 達也

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松英達也*1、志賀信哉*1、平澤英之*1、日野孝紀*1、大内忠司*2、吉良 真*2

*1 新居浜工業高等専門学校環境材料工学科、*2 新居浜工業高等専門学校ものづくり教育支援センター技術室

平成 22 年度高専教育講演論文集、331 頁-334 頁(2010).

[概要は前掲]

朝日 太郎

Influence of rare earth additives and boron component on electrical conductivity of sodium rare earth borate glasses

Susumu Nakayama*1, Takamitsu Watanabe*1, Taro Asahi*2, Hajime Kiyono*3, Yan Lin Aung*4, Masatomi Sakamoto*5

*1Department of Applied Chemistry and Biotechnology Niihama National College of Technology,

*2Department of Environmental Materials Engineering Niihama National College of Technology,

*3Hokkaido University, *4World-Lab Co., Ltd., *5Yamagata University

Ceramics International, Vol.36, p.2323-2327, 2010.

Sodium rare earth borate glasses $(\text{Na}_2\text{O})_{35.7}(\text{RE}_2\text{O}_3)_{7.2}(\text{B}_2\text{O}_3)_{57.1}$ (RE = Sm, Gd, Dy, Ho, Y, Er, and Yb), were prepared from a mixture of Na_2CO_3 , RE_2O_3 and B_2O_3 , and their properties as an Na^+ ionic conductor were investigated. Density increased with increasing atomic weight of RE. Crystallization temperature and crystal melting temperature of the present borate system was lower than that of the previously reported silicate and germanate system. Results of the ^{11}B NMR measurement suggested that half of all boron atoms are coordinated by four oxide ions to give a $[\text{BO}_4]$ tetrahedral unit and the others are coordinated by three oxide ions to give a $[\text{BO}_3]$ planar triangular unit. The electrical conductivity slightly decreased with increasing the ionic radius of RE^{3+} .

$(\text{Na}_2\text{O})_{35.7}(\text{RE}_2\text{O}_3)_{7.2}(\text{B}_2\text{O}_3)_{57.1}$ glass exhibited the electrical conductivity which is about one order of magnitude lower than those of the previously reported $(\text{Na}_2\text{O})_{35.7}(\text{RE}_2\text{O}_3)_{7.2}(\text{B}_2\text{O}_3)_{57.1}$ and $(\text{Na}_2\text{O})_{35.7}(\text{RE}_2\text{O}_3)_{7.2}(\text{B}_2\text{O}_3)_{57.1}$ glasses. It was assumed that this lower electrical conductivity is due to the lower content of Na^+ ions as conduction species in the former glass, compared with the latter two glasses.

日野 孝紀

Materials Separation from Pulverized Waste Printed Circuit Boards film capacitor

T. Hino*1, Y. Moriya*2, R. Agawa*3, Y. Tsugita*4, M. Nishida*4 and T. Araki*4

*1Environmental Materials Science and engineering, Niihama National College of Technology, *2First inc., *3Sumitomo Heavy Industries, Ltd., *4Department of Materials Science and Engineering, Ehime University

Journal of Environment and Engineering, Vol.5 No.2(2010) 383-388

We investigated the possibility of not only removal of the organic resin, but also magnetic separation of metals from pulverized PCB powder as a preliminary processing method of fusion

processing.

日野 孝紀

Effect of Droplets on Corrosion Resistance of Tantalum Oxide Films Fabricated by PLD

T. Hino^{*1}, M. Nishida^{*2}, Takao Araki^{*2}

^{*1}Environmental Materials Science and engineering, Niihama National College of Technology

^{*2}Materials Science and engineering, Ehime University

Journal of Laser Micro/Nanoengineering Vol.6 No.1 (2011) 10-14

The influence of metal-rich droplets on the corrosion resistance of tantalum oxide films was studied.

日野 孝紀

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松英達也^{*1}、志賀信哉^{*1}、平澤英之^{*1}、日野孝紀^{*1}、大内忠司^{*2}、吉良 真^{*2}

^{*1}新居浜工業高等専門学校環境材料工学科、^{*2}新居浜工業高等専門学校ものづくり教育支援センター技室
平成 22 年度高専教育講演論文集、331 頁-334 頁 (2010)

[概要は前掲]

高見 静香

Photoinduced shape changes of diarylethene single crystals: correlation between shape changes and molecular packing

Lumi Kuroki, ^{*1}Shizuka Takami, ^{*2}Kenji Yoza, ^{*3}Masakazu Morimoto^{*4} and Masahiro Irie^{*4}

^{*1}Department of Chemistry and Biochemistry, Graduate School of Engineering, Kyushu University,

^{*2}Niihama National College of Technology, ^{*3}Bruker AXS K.K.,

^{*4}Department of Chemistry and Research Center for Smart Molecules, Rikkyo University, *Photochemical & Photobiological Sciences* 2010, 9, 221-225.

Correlation between the photoinduced shape changes of diarylethene single crystals and their molecular packing in the crystals was studied. Crystals of 1,2-bis(5-ethyl-2-phenyl-4-thiazolyl)perfluorocyclopentene (3a) and 1,2-bis(2-isopropyl-5-phenyl-3-thienyl)perfluorocyclopentene (4a) showed similar photoinduced deformation from square to lozenge as that of 1,2-bis(2-ethyl-5-phenyl-3-thienyl)perfluorocyclopentene (1a). Although these three diarylethenes have different electronic structures and exhibit different colours upon UV irradiation, the crystallographic structures and molecular packing of the crystals are very similar to each other. The result indicates that the deformation mode is determined by the packing mode of component molecules in the crystal. X-Ray crystallographic analysis of a micrometre-sized crystal 1a (20 x 15 x 8 mm) prepared by sublimation revealed that the small-size crystal, which shows photoinduced deformation, has the same crystal structure as that of the large bulk crystal.

平澤 英之

HEAT GENERATION ABILITY IN AC MAGNETIC FIELD OF NEEDLE-TYPE Ti-COATED MILD STEEL FOR ABLATION CANCER THERAPY

T. Naohara^{*1}, H. Aono^{*1}, H. Hirazawa^{*2}, T. Maehara^{*1}, Y. Watanabe^{*3}, S. Matsutomo^{*4}

^{*1}Graduate School of Science and Engineering, Ehime University, ^{*2}Department of Environmental Materials Engineering, Niihama National College of Technology, ^{*3}Department of Surgery, Graduate School of Medicine, Ehime University, ^{*4}Department of Electronic Control Engineering, Niihama

National College of Technology

Proc. of the 10th International Symposium on Heating by Electromagnetic Sources, pp 507-511, (2010)

Considering for application as a novel ablation therapy of liver cancer, the heat generation ability of a Ti-coated mild steel rod was studied in an AC magnetic field at 300kHz. The outer diameter and length of the Ti-tubes were 1.8mm and 20mm, respectively, while the inner diameter was varied from 1.6mm to 0mm. The mild steel rod was embedded in a Ti-tube for preparing the needle-type specimen. Their heat generation ability was examined by changing the inclination angle to the magnetic flux direction in a high-frequency coil. When the thickness of the Ti surrounding the mild steel rod was as low as 0.1mm, the heat generation ability was drastically different among the three inclination angles ($\theta = 0^\circ, 45^\circ, \text{ and } 90^\circ$) to the magnetic flux direction due to the effect of the shape-induced magnetic anisotropy. However, the effect of the inclination angle was almost eliminated in the specimen surrounded by the 0.4mm thick Ti, suggesting that the non-oriented heat generation property is achieved for the needle-type mild steel rod coated with Ti having the optimum thickness. Based on these results, the prototype ablation needle having a complete non-oriented heat generation ability was fabricated to use in subsequent animal experiments.

平澤 英之

HEAT GENERATION ABILITY IN AC MAGNETIC FIELD OF NANO SIZED FERRITE POWDER PREPARED BY PHYSICAL BEAD MILLING FOR THERMAL COAGULATION THERAPY

H. Aono^{*1}, H. Hirazawa^{*2}, T. Naohara^{*1}, T. Maehara^{*1}, Y. Watanabe^{*3}

^{*1}Graduate School of Science and Engineering, Ehime University, ^{*2}Department of Environmental Materials Engineering, Niihama National College of Technology, ^{*3}Department of Surgery, Graduate School of Medicine, Ehime University

Proc. of the 10th International Symposium on Heating by Electromagnetic Sources, pp 483-489, (2010)

Nano-sized FeFe_2O_4 ferrite powder having heat generation ability in an AC magnetic field was prepared by bead milling for the application of thermal coagulation therapy. A commercial sample (non-milled sample) of 2.0 μm in particle size showed a temperature enhancement (ΔT) of 3 $^\circ\text{C}$ in an AC magnetic field (370 kHz, 1.77 kA/m). The heat generation ability in the AC magnetic field improved with the milling time, i.e., due to a decrease in the average crystal size for all the ferrites examined. The highest heat ability ($\Delta T=26^\circ\text{C}$) in the AC magnetic field was shown for the fine FeFe_2O_4 powder of 4.7 nm crystal size (the samples milled for 6 h using 0.1mm ϕ beads). However, the heat generation ability decreased for excessively milled samples with average crystal sizes of less than ca. 4.0 nm for FeFe_2O_4 . The heat generation of the samples showed some dependence on the hysteresis loss for the B-H magnetic property. One of the reasons for the high heat generation properties of the milled samples would be ascribed to an increase in the hysteresis loss by formation of a single magnetic domain. Moreover, the improvement in the heating ability was obtained by calcination at 500 $^\circ\text{C}$ of the bead-milled sample. In this case, the maximum heat generation ($\Delta T=59^\circ\text{C}$) ability was obtained by the crystal growth with the sample calcinations from the supermagnetic particles to single magnetic domain particles.

平澤 英之

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松英達也^{*1}, 志賀信哉^{*1}, 平澤英之^{*1}, 日野孝紀^{*1}, 大内忠司^{*2}, 吉良真^{*2}

*1 新居浜工業高等専門学校環境材料工学科、*2 新居浜工業高等専門学校ものづくり教育支援センター技術室

平成 22 年度高専教育講演論文集, pp331-334, (2010)

〔概要は前掲〕

平澤 英之

Preparation of MgFe₂O₄ microsphere using spray dryer for embolization therapy application

Hiromichi AONO*¹, Takashi NAOHARA*¹, Tsunehiro MAEHARA*¹, Hideyuki HIRAZAWA*² and Yuji WATANABE*³

*¹Graduate School of Science and Engineering, Ehime University, *²Department of Environmental Materials Engineering, Niihama National College of Technology, *³Department of Surgery, Graduate School of Medicine, Ehime University

Journal of the Ceramics Society of Japan 118 (12), pp.1207- 1211 (2010).

MgFe₂O₄ microspheres having a 2032 μm diameter range were prepared by a spray dryer using bead-milled nano-sized particles. A commercial powder having a several μm particle size was bead-milled to an approximate 6.2nm crystallite size. The microspheres were obtained using the spray dryer when the air pressure was low (0.03 MPa). The yield of the MgFe₂O₄ 2032 μm microspheres was improved by combination of a low air pressure and high ferrite concentration in the slurry. The heat generation ability in an AC magnetic field (370 kHz, 1.77 kA/m) was improved by the bead milling.

平澤 英之

Heat Generation Ability in AC Magnetic Field and Their Computer Simulation for Ti Tube Filled with Ferrite Powder

Hiromichi Aono*¹, Takashi Naohara*¹, Tsunehiro Maehara*¹, Hideyuki Hirazawa*², Shinya Matsutomo*³, Yuji Watanabe*⁴

*¹Graduate School of Science and Engineering, Ehime University, *²Department of Environmental Materials Engineering, Niihama National College of Technology, *³Department of Electronic Control Engineering, Niihama National College of Technology, *⁴Department of Organ Regenerative Surgery, Ehime University Graduate School of Medicine

J. Magn. Magn. Mater., 323, 88-93 (2011.11)

The heat generation ability of needle-type materials was studied for the application of thermal coagulation therapy in an AC magnetic field. Although the Ti tube without the MgFe₂O₄ powder or Ti rod showed poor heat generation abilities in an AC magnetic field, the temperature was significantly increased by the presence of ferrite powder in the Ti tube. We confirmed using a computer simulation that the eddy loss of the Ti tube was increased by the enhanced magnetic flux density due to the ferrite powder in the Ti tube. The heat generation of the ferrite filled Ti tube was increased by utilization of the quenched MgFe₂O₄ powder from elevated temperature. The relative magnetic permeability of the quenched ferrite was enhanced with the decrease in the inverse ratio of the cubic spinel structure. The heat generation ability was increased with the increase in the relative magnetic permeability of the Ti tube with ferrite powder. The calculated joule loss based on the experimental results showed an agreement with those using the computer simulation.

平澤 英之

Heat generation ability in AC magnetic field of nano MgFe₂O₄-based ferrite powder prepared by bead milling

Hideyuki Hirazawa^{*1}, Hiromichi Aono^{*2}, Takashi Naohara^{*2}, Tsunehiro Maehara^{*2}, Mitsunori Sato^{*3} and Yuji Watanabe^{*4}

^{*1}Department of Environmental Materials Engineering, Niihama National College of Technology,

^{*2}Graduate School of Science and Engineering, Ehime University, ^{*3}AdMeTech Co. Ltd. ^{*4}Department of Surgery, Graduate School of Medicine, Ehime

Journal of Magnetism and Magnetic Materials, vol323, Issue6, pp.675-680, (2011)

Nanosized MgFe₂O₄-based ferrite powder having heat generation ability in an AC magnetic field was prepared by bead milling and studied for thermal coagulation therapy applications. The crystal size and the particle size significantly decreased by bead milling. The heat generation ability in an AC magnetic field improved with the milling time, i.e. a decrease in crystal size. However, the heat generation ability decreased for excessively milled samples with crystal sizes of less than 5.5 nm. The highest heat ability ($\Delta T=34$ C) in the AC magnetic field (370kHz, 1.77kA/m) was obtained for fine MgFe₂O₄ powder having a ca. 6 nm crystal size (the samples were milled for 6-8 h using 0.1 mm Φ beads). The heat generation of the samples was closely related to hysteresis loss, a *B-H* magnetic property. The reason for the high heat generation properties of the samples milled for 6-8 h using 0.1 mm Φ beads was ascribed to the increase in hysteresis loss by the formation of a single domain. Moreover, the improvement in heating ability was obtained by calcination of the bead-milled sample at low temperature. In this case, the maximum heat generation ($\Delta T=41$ C) ability was obtained for a ca. 11 nm crystal size sample was prepared by crystal growth during the sample calcination. On the other hand, the ΔT value for Mg_{0.5}Ca_{0.5}Fe₂O₄ was synthesized using a reverse precipitation method decreased by bead milling.

平澤 英之

NEW HEAT GENERATION MATERIAL IN AC MAGNETIC FIELD FOR Y₃Fe₅O₁₂-BASED POWDER MATERIAL SYNTHESIZED BY REVERSE COPRECIPITATION METHOD

Hiromichi Aono^{*1}, Kenji Moritani^{*1}, Takashi Naohara^{*1}, Tsunehiro Maehara^{*1}, Hideyuki Hirazawa^{*2}, and Yuji Watanabe^{*3}

^{*1}Graduate School of Science and Engineering, Ehime University, ^{*2}Department of Environmental Materials Engineering, Niihama National College of Technology, ^{*3}Department of Surgery, Graduate School of Medicine, Ehime

Materials Letters, in press (2011)

We found the most promising powder material for the application of the thermal coagulation therapy for the treatment of cancerous tissues. The maximum heat generation ability ($\Delta T=40-77^{\circ}\text{C}$, 370kHz, $1.77\text{kA}\cdot\text{m}^{-1}$) was obtained for the powder materials by the calcination at 1100°C for the Y_{3-x}Gd_xFe₅O₁₂ system. This ΔT value is higher than ca. $\Delta T=30^{\circ}\text{C}$ in same magnetic field for fine FeFe₂O₄ particles as the candidate material for this type of therapy. The particle growth with the formation of the cubic single phase might influence to the high heat generation. As an unexpected result, the Gd₃Fe₅O₁₂ (X=3) has no heat generation ability in an AC magnetic field.

平澤 英之

Heat Generation Ability in AC Magnetic Field for Y₃Fe₅O₁₂-based Garnet Ferrite

H. Hirazawa*¹, H. Aono*², T. Naohara*², T. Maehara*², and Y. Watanabe*³

*¹Department of Environmental Materials Engineering, Niihama National College of Technology,

*²Graduate school of Science and Engineering, Ehime University, *³Department of Organ Regenerative Surgery, Graduate School of Medicine, Ehime University

IOP Conference Series: Materials Science and Engineering, in press (2011)

The $Y_3Fe_5O_{12}$ -based ferrite, i. e., $Y_{3-x}Gd_xFe_5O_{12}$ system was synthesized using a reverse coprecipitation method for application of new thermal coagulation therapy using an AC magnetic field for the treatment of cancerous tissues. The mixed phase of the $Y_3Fe_5O_{12}$ -type orthorhombic and cubic materials without any impurities were obtained for this systems calcined at low temperature in XRD results. However the orthorhombic phase almost disappeared by the calcination at 1150°C or higher temperature for all the X samples. The calcination temperature strongly influenced the heat generation ability. The maximum heat generation ability ($\Delta T=40-63^\circ C$, 370kHz, 1.77kA/m) was obtained for the powder materials sintered at 1100°C for the $Y_{3-x}Gd_xFe_5O_{12}$ system. The particle growth with the formation of the cubic single phase strongly influenced to the heat generation.

〔区 分 C〕

朝日 太郎

大気開放型 MOCVD 法による La-Si-O 膜の作製

中山 享*¹、加藤勇太*²、朝日太郎*³、勇 浩二*⁴

*¹新居浜工業高等専門学校生物応用化学科、*²新居浜工業高等専門学校生物応用化学科（現 リンテック 株）、*³新居浜工業高等専門学校環境材料工学科、*⁴ヒートシステム株

新居浜工業高等専門学校紀要、第 47 巻、p. 27-30、2011.

大気中で操作する簡易型 MOCVD（有機金属化学気相法）装置を用いて、Si（100）基板上へのアパタイト型構造を有する La-Si-O 薄膜形成を検討した。（102）面に配向したエピタキシャル La-Si-O 薄膜が、800～1000°C の基板温度で形成できた。800°C の基板温度で得られた La-Si-O 薄膜の膜厚は、成膜時間 15 分間で 0.6 μm 程度であった。

朝日 太郎

Na₂O-RE₂O₃-B₂O₃ 系ガラス (RE:希土類) の作製と熱特性評価

朝日太郎*¹、中山 享*²

*¹新居浜工業高等専門学校環境材料工学科、*²新居浜工業高等専門学校生物応用化学科

新居浜工業高等専門学校紀要、第 47 巻、p. 43-46、2011.

Na⁺イオン導電性セラミックスはガスセンサーや Na-S 電池等の重要な電解質材料であり、β"-Al₂O₃ や Na₃Zr₂Si₂P₂O₁₂ 等と共に、Shannon らによって検討された Na₅RESi₄O₁₂ セラミックス (RE:希土類元素) も高い導電性を示す超ナトリウムイオン導電性セラミックスである。我々は、これまでに Shannon らによって報告された Na₅RESi₄O₁₂ セラミックス組成に着目して、化学量論比の等しい組成のガラス試料の作製を試み、試料の熱特性やセラミックスと比較した電気特性の検討を行ってきた。今回の実験では、Shannon らによって報告された系での SiO₂ を B₂O₃ に置換した系で、ガラス化が確認された試料において、ガラス転移温度や結晶化温度などを測定し、試料の熱的性質について検討した。

〔区 分 E〕

新田 敦己

Anatase 型 TiO₂ を含む結晶化ガラスの作製および光触媒特性

新田敦己*1、大内忠司*2

*1新居浜工業高等専門学校環境材料工学科、*2新居浜工業高等専門学校ものづくり教育支援センター技術室
日本セラミックス協会 2011年年会 2011年年会講演予稿集 2011年、P.95

Glass-ceramics prepared by B_2O_3 - TiO_2 - SrO system were characterized by XRD, DTA and photodecomposition method. The glass was crystallized at 610 to 700C for 60 min in the atmosphere. The glass heat-treated at 650C was only an anatase-type TiO_2 crystal. The anatase-type TiO_2 crystal in the glass-ceramics heat-treated at 650C had an effect on the degradation behavior of methylene blue. In heat-treatment at 670C, a crystal of SrB_6O_{10} was deposited in the glass. The crystals of anatase and rutile type were deposited in the glass heat-treated at 700C. The above result shows that SrO in the glass raises the transformation temperature from an anatase-type of TiO_2 to a rutile-type. It is possible to prepare a bulk of glass-ceramics with a photocatalytic function.

志賀 信哉

材料工学科におけるものづくりプロセスを取り入れた技術者教育への取り組み

松英達也*1、志賀信哉*1、平澤英之*1、日野孝紀*1、大内忠司*2、吉良 真*2

*1新居浜工業高等専門学校環境材料工学科 *2新居浜工業高等専門学校技術室

平成22年度独立行政法人国立高等専門学校機構主催教育教員研究集会(長岡市)・2010年8月

[概要は前掲]

松英 達也

熱処理によるTi-O-N系薄膜の形成に関する研究

松英達也*1、西田真之*2、英 崇夫*3

*1新居浜工業高等専門学校環境材料工学科、*2神戸市立工業高等専門学校機械工学科

*3徳島大学大学院ソシオテクノサイエンス研究部

・第19回 日本材料科学会四国支部講演大会(新居浜)・2009年6月

本研究ではTi-O-N系薄膜を簡便に形成する手法として、直接目的とする薄膜を形成するのではなくTN薄膜を大気中で加熱処理を行うことにより得る方法に着目し、その検証を試みた。ここで原材料のTiN薄膜の形成には様々な手法が報告されているが、その中でもアークイオンプレーティング(AIP)法によるものは高硬度と基板との高い密着性を得られ、さらに薄膜の成長速度も早いことから工業的にも多く用いられている。そのため、AIP法によるTiN薄膜を用いて形成したTi-O-N系薄膜に関する諸特性について検討を行った。

松英 達也

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*1新居浜工業高等専門学校環境材料工学科、*2新居浜工業高等専門学校技術室

平成22年度独立行政法人国立高等専門学校機構主催教育教員研究集会(長岡市)・2010年8月

[概要は前掲]

朝日 太郎

碎石廃泥の溶融処理によるガラスの作製と熱特性評価

朝日太郎*

*新居浜工業高等専門学校環境材料工学科白

第8回 全国高専テクノフォーラム 2010年8月

碎石廃泥は天然石由来であるため、シリカやアルミナのようなガラス構成成分を含有していることが予

想され、溶融処理によりガラス化が可能と考えられる。碎石廃泥をガラス化することにより、タイル、レンガなどの路盤材やコンクリート骨材などとしての再利用も可能であると考えられる。本研究では、碎石廃泥の再利用化と省資源化の観点から、各種建築土木材料や骨材への変換を目指して、碎石廃泥の溶融処理による均一なガラス試料の作製を試み、添加物との混合割合による溶融状態と熱的性質の変化について検討を行った。

朝日 太郎

ペロブスカイト酸化物の炭素燃焼への影響

徳永龍志郎*¹、朝日太郎*²、中山享*³

*¹新居浜工業高等専門学校専攻科生物応用化学専攻、*²新居浜工業高等専門学校環境材料工学科、*³新居浜工業高等専門学校生物応用化学科

第 17 回 ヤングセラミスト・ミーティング in 中四国 2010 年

ペロブスカイト型酸化物の高い炭素燃焼触媒特性に注目し、出発原料に RE_2O_3 および Cr_2O_3 、 Fe_2O_3 、 CoO を用い固相反応法にて調製し、 $REMO_3$ (RE : 希土類元素、 M : Cr 、 Fe 、 Co) を調製し、さらに共沈法により $LaMO_3$ を調製した。 $REMO_3$ は、希土類元素のイオン半径が小さくなると炭素燃焼温度が上昇する傾向が見られた。また、 $LaCrO_3$ および $LaFeO_3$ において共沈法で調製した場合、固相反応法により調製した場合より高い炭素燃焼触媒特性を示すことがわかった。炭素燃焼に伴う活性化エネルギーは、炭素燃焼温度との間に顕著な相関性は見られなかった。 $LaMO_3$ 触媒を用いた場合、活性化エネルギー約 $80kJ \cdot mol^{-1}$ であり、炭素のみを燃焼させるよりも約 $50kJ \cdot mol^{-1}$ ほど低かった。

朝日 太郎

リチウムイオン導電体を用いた全固体型 pH 電極の応答特性

飯尾歩美*¹、中山享*¹、桑田茂樹*¹、朝日太郎*²

*¹新居浜工業高等専門学校生物応用化学科、*²新居浜工業高等専門学校環境材料工学科

第 15 回高専シンポジウム 2010 年

リチウムイオン導電体を用いた固体型電極と Nafion 膜でコーティングした $Ag/AgCl$ 基準電極からなる全固体型 pH 電極を作製し、pH 変化や温度変化に伴う起電力の応答性や再現性について検討した。その結果、次のことが明らかとなった。(1) Nafion 膜でコーティングした $Ag/AgCl$ 電極は固体基準電極として使用可能である。(2) $Li_3YSi_4O_{11}$ 、 $Na_4YSi_4O_{11.5}$ を用いた固体型電極の起電力の pH 応答性・再現性はいずれも良好であり、感度においては $Li_3YSi_4O_{11}$ を用いた電極の方がよい。(3) $Li_3YSi_4O_{11}$ 、 $Na_4YSi_4O_{11.5}$ を用いた固体型電極の電極電位は温度変化に対してネルンスト式に従う。(4) 実用化に向けた地下水用全固体型電極も pH 応答性が良好で、2 点校正法により実際の pH が測定可能である。

日野 孝紀

巨大青銅鏡作りにおける化学組成の検討

市原 武*¹、日野孝紀*²

*¹新居浜工業高等専門学校材料工学科、*²新居浜工業高等専門学校環境材料工学科

第 16 回四国地区材料関連学協会支部・研究会連合講演会 講演概要集 p. 9-10 (2011. 3)

大型青銅鏡を作製するにあたって、金属組織変化に及ぼす化学成分の影響を検討した。

日野 孝紀

$[(BaSnO_3)_{20}/(BaTiO_3)_{20}]_{21}$ 人工超格子薄膜の誘電特性に及ぼす配列秩序度の影響

伊藤辰徳*¹、日野孝紀*²

*¹新居浜工業高等専門学校生産工学専攻、*²新居浜工業高等専門学校環境材料工学科

第 16 回四国地区材料関連学協会支部・研究会連合講演会 講演概要集 p. 11-12 (2011. 3)

[$(\text{BaSnO}_3)_{20}/(\text{BaTiO}_3)_{20}$]₂₁ 人工超格子薄膜の誘電特性を調査した。

日野 孝紀

TiO₂ 被覆カーボン繊維の光触媒効果

伊藤辰徳^{*1}、日野孝紀^{*2}

^{*1} 新居浜工業高等専門学校生産工学専攻、^{*2} 新居浜工業高等専門学校環境材料工学科
第 16 回四国地区材料関連学協会支部・研究会連合講演会 講演概要集 p. 13-14 (2011. 3)
TiO₂ をコーティングしたカーボン繊維の光触媒効果を検討した。

日野 孝紀

SPS を用いた A6061 と AZ31 の接合条件の検討

和田 仁^{*1}、日野孝紀^{*2}

^{*1} 新居浜工業高等専門学校生産工学専攻、^{*2} 新居浜工業高等専門学校環境材料工学科
第 16 回四国地区材料関連学協会支部・研究会連合講演会 講演概要集 p. 15-16 (2011. 3)
SPS による A6061 と AZ31 の最適接合条件を検討した。

日野 孝紀

材料工学科におけるものづくりプロセスを取り入れた技術者教育への取り組み

松英達也^{*1}、志賀信哉^{*1}、平澤英之^{*1}、日野孝紀^{*1}、大内忠司^{*2}、吉良 真^{*2}

^{*1} 新居浜工業高等専門学校環境材料工学科、^{*2} 新居浜工業高等専門学校技術室
平成 22 年度独立行政法人国立高等専門学校機構主催教育教員研究集会(長岡市) (2010. 8)
〔概要は前掲〕

高見 静香

Synthesis and photochromic properties of 1-thiazolyl-2-vinylcyclopentene derivatives

Shizuka Takami*, Yusuke Abe*, Kazuyuki Shimizu* and Ayano Shimizu*

*Niihama National College of Technology

6th International Symposium on Organic Photochromism, October 17-21, 2010

In this study, we have synthesized two 1-thiazolyl-2-vinylcyclopentene derivatives 2a and 3a to obtain yellow photochromic compounds having a low photocycloreversion quantum yield. The photochromic properties of 2 and 3 were also compared with that of 1. All of these compounds underwent reversible photochromic reactions. Compounds 1a, 2a and 3a in toluene solutions changed the color upon 313 nm light irradiation from colorless to yellow, in which absorption maxima were observed at 416 nm, 424 nm and 419 nm, respectively.

高見 静香

黄色に光発色するフォトクロミック分子の開発と光および熱安定性の制御

高見静香*

*新居浜工業高等専門学校環境材料工学科

文科省科学研究費補助金 特定領域 研究成果発表 1月21日 立教大学池袋キャンパス

ビニル部位にフェニル基を導入した誘導体 1a および 2a を合成しそのフォトクロミック挙動を検討した。1a および 2a のトルエン溶液に紫外光 313 nm を照射すると無色から黄色に着色し、極大吸収波長はそれぞれ 424 nm と 419 nm であった。また、いずれの誘導体も紫外、可視光照射により可逆なフォトクロミズムを示し、1a および 2a の光転換率はそれぞれ 95% と 83% であった。また、黄色に発色するフォトクロミック誘導体のなかでも大きなモル吸光係数 (17100 と 16900 M⁻¹cm⁻¹) を示すことがわかった。さらに、化合物

1b と 2b の光開環反応量子収率はいずれも 10^{-3} オーダであり、室内光では容易に光退色しにくいことがわかった。光着色体は熱的に安定であり、80°Cにおいて 100 時間後も変化は認められなかった。

平澤 英之

Y₃Fe₅O₁₂を基本とするフェライトの交流磁場中での発熱特性

青野宏通^{*1}、平澤英之^{*2}、猶原 隆^{*1}、前原常弘^{*1}、渡部祐司^{*1}

^{*1} 愛媛大学、^{*2} 新居浜工業高等専門学校環境材料工学科

第 27 回希土類討論会 2010 年 5 月

The heat generation ability of powder-type magnetic materials was studied for the application of new thermal coagulation therapy in an AC magnetic field. We found that the Y₃Fe₅O₁₂-based powder material shows high heat generation ability in AC magnetic field. The obtained precursors of homogeneous hydroxides using this method were calcined at 1000°C–1300°C for the preparation of Y₃Fe₅O₁₂ powder. The maximum heat generation ability ($\Delta T=40\text{--}63^\circ\text{C}$, 370kHz, 1.77kA/m) was obtained for the samples sintered at 1100°C for the Y_{3-x}Gd_xFe₅O₁₂ system. The mixed phase of cubic and orthorhombic for Y₃Fe₅O₁₂ was formed for the samples calcined below 1100°C. The single cubic phase was obtained for the samples calcined at 1150°C and higher. The particle growth with the formation of the cubic single phase acted to decrease the heat ability for higher sintering temperature.

平澤 英之

Tiを被覆した炭素鋼丸棒の交流磁場中での発熱特性

白井健太郎 (院生)^{*1}、猶原 隆^{*1}、青野宏通^{*1}、前原常弘^{*1}、平澤英之^{*2}、松友真哉^{*3}

^{*1} 愛媛大学、^{*2} 新居浜工業高等専門学校環境材料工学科、^{*3} 新居浜工業高等専門学校電子制御工学科

日本金属学会 2010 年秋季大会 2010 年 9 月

癌の新規治療法として、腫瘍を熱により凝固壊死させる交流磁場誘導焼灼法が注目されている。我々は、強磁性体金属針を用いた治療法の確立を目指しているが、腫瘍部に穿刺するには生体適合性を有する Ti で被覆する必要がある。本研究では、炭素鋼丸棒を取り巻く Ti 層の厚さ、及び磁束方向との角度変えた場合の交流磁場中での発熱挙動を調べた。さらに、熱解析シミュレーションを用いて発熱機構を調べるとともに、発熱特性の実測値との比較検討を行った。

平澤 英之

ガーネット系 Y₃Fe₅O₁₂ フェライトのビーズミル粉砕による微粒子化と交流磁場中での発熱特性

江原弘規^{*1}、青野宏通^{*1}、猶原 隆^{*1}、前原常弘^{*1}、渡部祐司^{*1}、平澤英之^{*2}

^{*1} 愛媛大学、^{*2} 新居浜工業高等専門学校環境材料工学科

日本セラミックス協会 2011 年年会 2011 年 3 月

Nano-sized FeFe₂O₄ ferrite powder having heat generation ability in an AC magnetic field was prepared by bead milling for the application of thermal coagulation therapy. The heat generation ability (W·g⁻¹) can express using $3.5 \times 10^{-4} fH^2$ in frequency (f/kHz) and the magnetic field (H/kA·m⁻¹) for the sample milled for 4 using 0.1 mm ϕ beads.

平澤 英之

ビーズミル粉砕により得られたナノ微粒子の交流磁場中における発熱機構

渡部祐輔^{*1}、青野宏通^{*1}、猶原 隆^{*1}、前原常弘^{*1}、渡部祐司^{*1}、平澤英之^{*2}

^{*1} 愛媛大学、^{*2} 新居浜工業高等専門学校環境材料工学科

日本セラミックス協会 2011 年年会 2011 年 3 月

Fine nano-sized FeFe₂O₄ powder was prepared by bead milling for 6 hours using 0.1mm ϕ beads. Heat

generation ability in the AC magnetic field for nano-sized FeFe_2O_4 was proportional to its frequency and square of magnetic field. Heat generation ability P ($\text{W} \cdot \text{g}^{-1}$) can express using following equation $P=1.07 \times 10^{-4} \cdot f \cdot H^2$, where f and H are frequency (kHz) and magnetic field ($\text{kA} \cdot \text{m}^{-1}$), respectively.

平澤 英之

塞栓療法への応用を目的としたスプレードライ法による $\text{Y}_3\text{Fe}_5\text{O}_{12}$ フェライトマイクロ球体の作製

仙波亮太^{*1}、青野宏通^{*1}、猶原 隆^{*1}、前原常弘^{*1}、渡部祐司^{*1}、平澤英之^{*2}

^{*1} 愛媛大学、^{*2} 新居浜工業高等専門学校環境材料工学科

日本セラミックス協会 2011 年年会 2011 年 3 月

$\text{Y}_3\text{Fe}_5\text{O}_{12}$ microspheres having a 20-32 μm diameter range was prepared by a spray dry method using bead-milled nano-sized particles. Although commercial $\text{Y}_3\text{Fe}_5\text{O}_{12}$ showed poor heat generation ability, the bead-milled powder having about 16 nm in crystal size showed high heat generation ability in an AC magnetic field. The yield of 20-32 μm particle was 6.6 wt% versus the starting powder.

平澤 英之

逆共沈法により得られた $\text{Y}_3\text{Fe}_5\text{O}_{12}$ 系フェライト粉末の交流磁場中における発熱特性

西森忠彦^{*1}、青野宏通^{*1}、猶原 隆^{*1}、前原常弘^{*1}、渡部祐司^{*1}、平澤英之^{*2}

^{*1} 愛媛大学、^{*2} 新居浜工業高等専門学校環境材料工学科

日本セラミックス協会 2011 年年会 2011 年 3 月

We prepared the $\text{Y}_3\text{Fe}_5\text{O}_{12}$ ferrite using a reverse coprecipitation method. The maximum heat generation ability (ΔT) was obtained for the samples calcined at 1100°C . The calcined temperature of the maximum ΔT value would depend on the crystal growth with the phase change between orthorhombic and cubic phases. Heat generation ability of the $\text{Y}_3\text{Fe}_5\text{O}_{12}$ is proportional to the cube of the strength of magnetic field.