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Moisture-Induced Delayed Alumina Scale Spallation on a Ni(Pt)Al Coating (Preprint) Apr-2009 32 pages

Authors: James L Smialek; NATIONAL AERONAUTICS AND SPACE ADMINISTRATION CLEVELAND OH GLENN RESEARCH CENTER

Full Text

Delayed scale failure was examined for samples of a Ni(Pt)Al-coated CMSX4 single crystal superalloy, cyclically oxidized at 1150 degrees C for 2000 hr. One sample exhibited accentuated coating grain boundary wrinkling, initiating local alumina scale spallation to bare metal, resulting in a final weight loss of 3.3 milligrams/(square centimeter). Spallation under ambient conditions was monitored with time after cooldown and was found to continue for times up to 24 hr, ...

Advanced Nanocrystalline Ceramic Matrix Composites with Improved Toughness 09-Jan-2009 29 pages

Authors: Amiya Mukherjee; Katherine Thomson; CALIFORNIA UNIV DAVIS DEPT OF CHEMICAL ENGINEERING AND MATERIALS SCIENCE

Full Text

Alumina-based nanocomposites reinforced with niobium and/or carbon nanotubes were fabricated by advanced powder processing techniques and consolidated by spark plasma sintering. Raman spectroscopy revealed that single-walled carbon nanotubes (SWCNT) begin to break down at sintering temperatures above 1150 deg C. Nuclear magnetic resonance (NMR) showed that, although thermodynamically unlikely, no Al4C3 formed in the CNT-alumina nanocomposites. Thus, the nanocomposite is purely a physical mixture and no chemical bond was formed ...

Dynamic Failure Processes Under Confining Stress in AlON, a Transparent Polycrystalline Ceramic Dec-2008 9 pages

Authors: James W McCauley; B Paliwal; K T Ramesh; Mingwei Chen; SANDIA NATIONAL LABS ALBUQUERQUE NM

Full Text

An experimental technique is developed to impose a planar lateral confinement in a prismatic specimen (with rectangular cross-section); the setup enabled a controlled and homogeneous stress state with high lateral compressive stresses. A transparent polycrystalline aluminum oxynitride (AlON) specimen was used for the study. The statically pre-compressed specimen was then subjected to axial dynamic compressive loading using a modified compression Kolsky bar setup. Experimental design was performed using 3D computational ...

Protection of Polymer from Atomic-Oxygen Erosion using Al2O3 Atomic Layer Deposition Coatings Jan-2008 5 pages

Authors: Russell Cooper; Timothy K Minton; Steven M George; Hari P Upadhyaya; Michael R Berman; Xiaohua Du; MONTANA STATE UNIV BOZEMAN DEPT OF CHEMISTRY AND BIOCHEMISTRY

Full Text

Thin films of Al2O3 grown using atomic layer deposition (ALD) techniques can protect polymers from erosion by oxygen atoms. To quantify this protection, polyimide substrates with the same chemical repeat unit as Kapton (registered trademark) were applied to quartz crystal microbalance (QCM) sensors. Al2O3 ALD films with varying thicknesses were grown on the polyimide substrates. The ALD-coated polyimide materials were then exposed to a hyperthermal atomic-oxygen beam. The mass loss ...

Consolidation of A12O3 Nano-Power by Magnetic Pulsed Compaction and Sintering 16 OCT 2007 13 pages

Authors: Whung W. Kim; KOREA ATOMIC ENERGY RESEARCH INST DAEJEON NUCLEAR MATERIAL TECHNOLOGY DEVELOPMENT TEAM

Full Text

Successful ulta-fine nano Al2O3 powder was consolidated and sintered using magnetic pulsed compaction. Measurements indicated that many properties in the consolidated Al2O3 bulk have been much improved over the conventional polycrystalline materials. The optimization of the compaction parameters and sintering conditions will lead to the consolidation of Al2O3 nanopowder for the higher density and even further enhanced mechanical properties.

High Strain Rate Mechanical Properties of Epoxy and Epoxy-Based Particulate Composites (Preprint) MAY 2007 13 pages

Authors: Jennifer L. Jordan; Wayne Richards; Brad White; Jonathan E. Spowart; AIR FORCE RESEARCH LAB EGLIN AFB FL MUNITIONS DIRECTORATE

Full Text

Polymers and polymer-based particulate composites are becoming increasingly used in aerospace structural applications, where they experience complex, non-static loads. Correspondingly, the high strain rate mechanical

properties are of increasing importance. This paper investigates the properties of epoxy - bisphenol-A/diethanolamine epoxy (Epon 826/DEA) - and epoxy-based particulate composites across strain rates from 10 (exp -3) to 10(exp 5) /s. The samples were tested using Instron, traditional split Hopkinson pressure bars (SHPBs) and ...

Stoichiometry and Characterization of Aluminum Oxynitride Thin Films by Ion-Beam-Assisted Pulsed Laser Deposition (Preprint) JAN 2007 23 pages

Authors: J. S. Zabinski; J. J. Hu; J. E. Bultman; N. A. Pierce; A. A. Voevodin; DAYTON UNIV OH RESEARCH INST

Full Text

Oxides are inherently stable in air at elevated temperatures and may serve as wear resistant matrices for solid lubricants. Aluminum oxide is a particularly good candidate for a matrix because it has good diffusion barrier properties and modest hardness. Most thin film deposition techniques that are used to grow alumina require high temperatures to impart crystallinity. Crystalline films are about twice as hard as amorphous ones. Unfortunately, the mechanical properties ...

Global Mechanical Response and its Relation to Deformation and Failure Modes at Various Length Scales under Shock Impact in Alumina AD995 Armor Ceramic 01 NOV 2006 40 pages

Authors: D. P. Dandekar; J. W. McCauley; W. H. Green; N. K. Bourne; M. W. Chen; ARMY RESEARCH LAB ABERDEEN PROVING GROUND MD

Full Text

Polycrystalline aluminum oxide (Al2O3) based materials have both personnel and ground vehicle armor applications. However, as their ballistic performance can vary significantly it is important to identify the fundamental macro and micro mechanisms of deformation and failure in the ballistic event. This has proven elusive over the years. Using a newly developed soft recovery plate impact experiment, a multidisciplinary, multi-national collaboration has, for the first time, determined micro and macro ...

Template-Growth of Highly Ordered Carbon Nanotube Arrays on Silicon POSTPRINT SEP 2006 5 pages

Authors: Aijun Yin; Marian Tzolov; David Cardimona; Jimmy Xu; BROWN UNIV PROVIDENCE RI DEPT OF ENGINEERING

Full Text

This paper reports on the success in and the key conditions for direct growth or carbon nanotubes or unprecedented uniformity on silicon. The uniformity is ensured through the growth within the highly ordered nanopores or an alumina oxide template, which is in turn formed on silicon through anodization of aluminum of unprecedented thickness evaporated on silicon. The formation of highly ordered nanopore array by anodization of thick aluminum evaporated on ...

Effect of Environment on Creep Behavior of an Oxide/Oxide CFCC with 45 deg. Fiber Orientation JUN 2006 145 pages

Authors: Gregory T. Siegert; AIR FORCE INST OF TECH WRIGHT-PATTERSON AFB OH SCHOOL OF ENGINEERING AND MANAGEMENT

Full Text

Aerospace applications require materials capable of maintaining superior mechanical properties while operating at high temperatures and oxidizing environments. Nextel(trademark) 720/A (N720/A), an oxide/oxide ceramic matrix composite (CMC) with a porous alumina matrix was developed specifically to provide improved long-term properties and performance at 1200 deg C. This research evaluated the creep behavior of N720/A with a plus or minus 45 deg fiber orientation at 1200 deg C in: laboratory air, ...

Effects of Frequency and Environment on Fatigue Behavior of an Oxide-Oxide Ceramic Matrix Composite at 1200 Deg. C JUN 2006 118 pages

Authors: Griffin Hetrick; AIR FORCE INST OF TECH WRIGHT-PATTERSON AFB OH SCHOOL OF ENGINEERING AND MANAGEMENT

Full Text

Advances in aeronautical engineering in the 21st century depend upon materials that can perform well in extreme environments such as high temperatures and oxidizing conditions. Nextel(Trademark)720/Alumina (N720/A) is an oxide/oxide ceramic matrix composite with a porous alumina matrix that has been identified as a candidate material for such applications. This research investigated the effects of frequency on fatigue response of N720/A at 1200C in both air and steam environment. Prior ...

In Vitro Toxicity of Aluminum Nanoparticles in Rat Alveolar Macrophages MAR 2006 10 pages

Authors: Andrew Wagner; Charles Bleckmann; E. England; Krista Hess Saber /Hussain; John J. Schlager; AIR FORCE RESEARCH LAB WRIGHT-PATTERSON AFB OH HUMAN EFFECTIVENESS DIRECTORATE

Full Text

The purpose of this research was to investigate and characterize the in vitro cellular effects of exposing rat lung macrophages to aluminum oxide nanoparticles (30 and 40nm average size) compared to aluminum metal nanoparticles (50, 80, and 120nm). This study used toxicity endpoints involving cell viability, mitochondrial function, phagocytotic ability, and inflammatory response. Results indicated none to minimal toxicological effects occurred with exposure of macrophages as high as 500 microg/ml ...

In Vitro Toxicity of Aluminum Nanoparticles in Rat Alveolar Macrophages MAR 2006 111 pages

Authors: Andrew J. Wagner; AIR FORCE INST OF TECH WRIGHT-PATTERSON AFB OH SCHOOL OF ENGINEERING AND MANAGEMENT

Full Text

The purpose of this research is to characterize the in vitro cellular effects of rat lung macrophages to exposure to aluminum oxide nanoparticles (Al2O3-NP) (30 and 40nm) compared to aluminum nanoparticles (Al-NP) (50, 80, and 120nm). This study concentrates on cell viability, mitochondrial function, phagocytosis ability, and cytokine response. Results indicate no to minimal toxicological effects on macrophages exposed as high as 500 µg/ml for 24 hours with Al2O3-NP. However, ...

Effects of Machining on the Uniaxial and Equibiaxial Flexure Strength of CAP3 AD-995 Al2O3 SEP 2005 70 pages

Authors: Andrew A. Wereszczak; Jeffrey J. Swab; Reuben H. Kraft; ARMY RESEARCH LAB ABERDEEN PROVING GROUND MD

Full Text

The effect of surface condition on the uniaxial and equibiaxial flexure strength of CoorsTek's CAP3 AD-995 alumina was examined. (Note that this material was found not to be the same as CoorsTek's AD-955 alumina-a comparison and discussion of the differences are provided in this report.) The following four surface conditions were considered: as-fired (i.e., unmachined) surfaces; the condition produced by CoorsTek's standard surface-grinding procedures (i.e., the condition they will provide ...

The Influence of Particulates on Thruster Plume / Shock Layer Interaction at High Altitudes JAN 2005 13 pages

Authors: Sergey F. Gimelshein; Alina A. Alexeenko; Dean C. Wadsworth; Natalia E. Gimelshein; UNIVERSITY OF SOUTHERN CALIFORNIA LOS ANGELES

Full Text

A two-phase plume flow from a small aluminized propellant side thruster interacting with rarefied atmosphere at 120 km has been examined numerically. A three step continuum-kinetic approach has been used, with the Navier-Stokes equations solved inside the nozzle, and a 2D/3D DSMC method employed to compute the plume nearfield and then the plume-atmosphere interaction region. At each of these steps, a two-way gas-particulate coupling has been used. The DSMC implementation ...

Adsorption of Soluble Silica Species on Alumina Powders and Vice Versa 06 MAY 2004 8 pages

Authors: Biao Liu; Xiaojun Liu; Carl D. Meinhart; Fred F. Lange; CALIFORNIA UNIV SANTA BARBARA DEPT OF MATERIALS

Full Text

In an effort to texture a glass surface with alumina particles, we found that positively charged alumina particles were only attracted to the negatively charged silica substrates in aqueous solution for a very short period although the pH was between the iso-electric-point (IEP) of alumina and silica. Instead, experiments show that the glass surface attracted the dissolved species of alumina, which made the surface repel the alumina particles. It was ...

Oxidation Processes on Aluminum and Rhodium 17 MAR 2004 9 pages

Authors: Andrew M. Rappe; PENNSYLVANIA UNIV PHILADELPHIA DEPT OFCHEMISTRY

Full Text

During the reporting period, we have made new discoveries in the areas of oxide-supported nanocatalysts, quantum Monte Carlo methodlolgy, subsurface vacancies in metals, fundamental understanding of chemisorption, and self-assembled monolayers. We have completed the first major theoretical study of Pt chemisorbed on alumina. We contrast Pt nanoparticle and layer adsorption, focusing on how oxide defects influence the Pt growth, and the CO chemisorption properties on the nanoparticles. We have completed ...

Evaluation of Materials for Rapid Runway Repair 2004 6 pages

Authors: Michael Riley; CERATECH INC BALTIMORE MD

Full Text

While the goals of this effort are to improve the strength and thermal resistance characteristics of PaveMend products, ultimate cost will also be kept as a determining factor. The metal oxides currently used in PaveMend products are magnesia/alumina based, but are irregular shaped ground particulates. To add stiffness and additional compressive strength to the product, we will investigate the role of chopped ceramic fibers as low weight additives to the ...

High Temperature Materials Simulations on Parallel Computers 30 APR 2003 20 pages

Authors: Priya Vashishta; Rajiv K. Kalia; Aiichiro Nakano; LOUISIANA STATE UNIV BATON ROUGE

Full Text

Final Progress (1 May 99 - 30 Apr 03): This project deals with properties and processes in high-temperature materials (HTMs) that are vital to the DoD technology base. In this project, molecular-dynamics (MD) simulations have been performed to investigate: i) sintering of nanostructured SiC and high- pressure structural transformation in SiC; ii) dynamic fracture in nanostructured systems; iii) structure of amorphous Al2O3; and iv) reactive wetting of Al2O3 surface by ...

AB Initio Propagator Theory of Clusters 12 FEB 2003 15 pages

Authors: J. V. Ortiz; KANSAS STATE UNIV MANHATTAN DEPT OF CHEMISTRY

Full Text

Oxidative processes involving aluminum lead to the creation of many intermediates whose structure and reactivity stimulate intense study. Aluminum- rich species are especially pertinent to the growth and structure of interfaces between bulk Al2O3 and metallic Al phases. Ceramics, minerals, reactive surfaces and catalytic supports often consist of oxides of aluminum. This project aims to improve understanding of the basic interactions between atoms of oxygen and aluminum at the atomic ...

Microstructure and Dynamic Behavior Correlation in Two-Phase TiB2+Al2O3 Ceramic OCT 2002 104 pages

Authors: Naresh N. Thadhani; Min Zhou; GEORGIA INST OF TECH ATLANTA SCHOOL OFMATERIALS SCIENCE AND ENGINEERING

Full Text

The high-strain-rate deformation and damage response of four types of microstructurally-biased two-phase (nominally 30:70) TiB2+Al2O3 ceramics, produced by SHS or mechanical milling techniques, have been investigated in this work. The microstructural-bias includes differences in phase (grain) size and phase distribution, such that in one case a continuous (interconnected) TiB2 network surrounds the Al2O3 phase (qualitatively termed TA'), and in the other case the TiB2 and Al2O3 phases are interdispersed and ...

Preparation of Copper Aluminium Oxide by Spray Pyrolysis NOV 2001 4 pages

Authors: Ji-Youn Rim; Shin-Ae Song; Seung-Bin Park; KOREA ADVANCED INST OF SCIENCE AND TECHNOLOGY DAEJON DEPT OF CHEMICAL ENGINEERING

Full Text

Copper aluminium oxide(CuAlO2) particles a promissing p-type TCO(transparent conducting oxide), were prepared by spray pyrolysis. Delafossite phase of CuAlO2 was obtained when copper nitrate, copper acetate and copper sulfate, divalent copper precursors, were used as copper precursor and aluminium nitrate as aluminium precursors. However, when copper chloride (CuCl, a monovalent copper precursor) was used, the delafossite phase was not obtained regardless of the type of aluminium precursor. The O2-doped CuAlO2 ...

Magnetization Reversal and Magnetic Anisotropy of Fe, Ni and Co Nanowires in Nanoporous Alumina Membranes APR 2001 6 pages

Authors: M. Kroell; L. J. de Jongh; F. Luis; P. Paulus; G. Schmid; TRINITY COLL DUBLIN (IRELAND) DEPT OF PHYSICS

Full Text

The magnetization reversal and magnetic anisotropy of Fe, Ni and Co nanowires is studied at low temperatures. All nanowires show a strong shape anisotropy with the easy axis being parallel to the long axis of the wires. Co nanowires additionally show a temperature dependent magnetocrystalline anisotropy along the hexagonal c-axis, which is directed nearly perpendicular to the long axis of the wires, as is confirmed by X-Ray diffraction measurements and ...

Zirconia-Alumina-ITO Nanolaminates for Transparent, Conducting, Transformation-Toughening Coatings 15 NOV 2000 71 pages

Authors: Carolyn R. Aita; WISCONSIN UNIV-MILWAUKEE

Full Text

The revised objective of the proposed research was investigate room temperature interface alloy and compound formation in zirconia-bearing pseudobinary nanolaminate systems. Two model systems with the same nominal architecture but extremes in chemical reactivity between constituents were compared: zirconia-alumina (immiscible) and zirconia-yttria (completely miscible). The results showed that in zirconia-alumnina nanolaminates, layers were separate entity and with incoherent interfaces. The phase present in the zirconia layers was governed by the ...

Characterization of Nanometer- to Micron-Sized Aluminum Powders by Thermogravimetric Analysis 24 JUL 2000 29 pages

Authors: Curtis E. Johnson; Stephen Fallis; Thomas J. Groshens; Kelvin T. Higa; Ismail M. Ismail; NAVAL AIR WARFARE CENTER WEAPONS DIV CHINA LAKE CA

Full Text

The reactivity of aluminum powders was studied by thermogravimetric analysis in air, oxygen, and nitrogen. Weight gains from complete oxidation of the aluminum were used to calculate particle sizes in the range of 30 nm to 500 nm. These particle sizes correlated well with particle sizes derived from surface area measurement. Particle size was also examined by scanning electron microscopy and atomic force microscopy, and compared to crystallite size determined ...

Thermomechanical Behavior of Functionally Graded Materials 09 MAY 2000 31 pages

Authors: A. Almajid; S. Hudnut; M. Taya; UNIV OF WASHINGTON SEATTLE DEPT OF MECHANICAL ENGINEERING

Full Text

Functionally graded materials are studied with emphasis on fracture resistance behavior and piezoelectric performance. Several types of metal/ ceramic FGM plates are processed and their fracture resistance, Kr as a function of crack length was examined experimentally. The Kr behavior of the FGM plates are explained by two models successfully. Then, a new type of piezoelectric FGM plates are designed by using several models, classical lamination ...

Single Particle Studies of Heterogeneous Atmospheric Chemistry on Aluminum Oxide Particles in a Quadrupole Trap MAR 2000 89 pages

Authors: A. J. Hunter; D. M. Sonnenfroh; D. B. Oakes; W. T. Rawlins; PHYSICAL SCIENCES INC ANDOVER MA

Full Text

This report documents a research program consisting of laboratory and field measurements investigating the atmospheric chemistry and aerosol microphysics of the impacts of rocket motor exhausts on upper atmospheric chemical cycles and ozone. The experimental investigation employs a laboratory quadrupole trap electrodynamic levitation apparatus to study heterogeneous processes on single aluminum oxide particles representative of those exhausted into the atmosphere by solid rocket motors. We ...

The Effects of Colloidal Processing on the Densification of Titanium Diboride (TiB2) - Alumina (Al2O3) Composites MAR 2000 25 pages

Authors: Lisa P. Franks; Melissa J. Crimp; Ernest Chin; Gary Gilde; ARMY TANK-AUTOMOTIVE COMMAND WARREN MI

Full Text

Titanium diboride/Alumina (TiB2/Al2O3) powders produced using self-propagating high-temperature synthesis (SHS) can be hot pressed into armor tiles that exhibit superior resistance to penetration as compared to TiB2, SiC, B4C or Al2O3. As with other advanced ceramics however, difficulties in processing TiB2/Al2O3 arise from the inability to reproduce specimens having identical microstructure and properties. Since the SHS powders are available commercially, the interactions between TiB2 and Al2O3 have been analyzed with ...

Processing and Deposition of Nanocrystalline Oxide Composites for Thermal Barrier Coatings 31 DEC 1999 6 pages

Authors: Jackie Y. Ying; Justin T. McCue; MASSACHUSETTS INST OF TECH CAMBRIDGE DEPT OF CHEMICAL ENGINEERING

Full Text

This report describes the synthesis, thermal stability and coating of nanocrystalline oxide composites for thermal barrier coating applications. The composites consisted of alumina-zirconia and alumina-yttria stabilized zirconia. The effect of alumina and yttria content on zirconia phase stability was examined. It was found that alumina-zirconia composites underwent phase transformation upon heat treatment at 950-1100 C. A small amount of yttria additive (1%) prevented zirconia phase ...

Effects of pH, Surface Area, and Background Matrices on the Removal of Lead from Aqueous Solutions Using Activated Alumina 05 DEC 1999 129 pages

Authors: Patrick Wootton; AUBURN UNIV AL

Full Text

The metallic compound lead poses a human health risk and is environmentally toxic. The removal of lead from drinking and waste waters is therefore of great importance. To ensure that the lead concentration is reduced to safe levels, conventional treatment procedures for the removal of lead such as chemical precipitation and ion exchange have been used. These methods often do not yield sufficient removal of ...

Laboratory Studies of Al(2)O(3)-NO(x) Aerosols 30 SEP 1999 13 pages

Authors: Robert Disselkamp; John R. Edwards; Daniel Pilson; Tyrrel W. Smith Jr.; TRW SPACE AND ELECTRONICS GROUP REDONDOBEACH CA

Full Text

Laboratory experiments were performed to investigate the chemistry of aluminum oxide (gamma Al(2)0(3)) aerosol samples upon exposure to NO(x) (NO(x) is NO, NO(2), etc.,) gases. Static aerosol samples were generated in an aerosol chamber and studied at temperatures ranging from 298 to 183 K. Fornier-transform infrared (FTIR) absorption spectroscopy was used to study the aerosol samples over time. Each aerosol was created using the same procedure. First, a reactant gas ...

Characterization of the Uptake of Nitrogen Oxides on Alumina Adsorbents MAY 1999 162 pages

Authors: David A. Pocengal; FLORIDA UNIV GAINESVILLE DEPT OF ENVIRONMENTAL ENGINEERING SCIENCES

Full Text

The objective of this research was to develop a method that employed ion-specific electrodes (ISEs) to quantify nitrate and nitrite (NOx) in aqueous solutions that contained NOx exposed alumina and to correlate the quantities of these surface NOx species with the quantity of gaseous NOx sorbed. The final objective was to obtain material balances of NOx sorbed to nitrate and nitrite formed and to observe indicative relationships between the surface ...

Solid Sorbent Control of Nitrogen Oxides (NOx) 18 JAN 1999 272 pages

Authors: Maxwell R. Lee; FLORIDA UNIV GAINESVILLE COLL OF ENGINEERING

Full Text

Solid materials have demonstrated applicable control of combustion- source NOx. A support material of (gamma)-alumina can provide improved NOx sorption in comparison to a previously applied sorbent, magnesia-coated vermiculite. NOx sorption of treated (gamma)-alumina correlates with the ionization potential of the group-1 element. General mechanisms of NOx sorption have been developed for untreated, K2CO3-treated and KOH-treated (gamma)- alumina. Sorption of NO appears to increase formation of nitrine. Untreated (gamma)-alumina formed ...

Low Power GaAs Enhancement - Depletion Technology using Native Al2O3 as an Insulator 11 MAY 1998 16 pages

Authors: Brian Thibeault; WIDEGAP TECHNOLOGY WESTLAKE VILLAGE CA

Full Text

The WiTech phase I objectives were to explore the feasibility of Al2O3 as a buffer layer insulator for GaAs-on-insulator (GOI) technology and as a gate insulator for GaAs-based MISFETs. specifically, we have: (1) investigated the oxidation process and its effect on active device layers, showing the very little or no detrimental effect of the oxidation on the active region can be achieved by using LT-AlGaAs buffer layers. (2) fabricated an ...

A.S.E. Source at 1550nm for IFOG Applications 05 DEC 97 3 pages

Authors: Annand Gopinath; William Berglund; Ben Ellerbusch; MINNESOTA UNIV MINNEAPOLIS DEPT OF ELECTRICAL ENGINEERING

Full Text

We performed annealing studies for the Al2O3 guides, and we have identified the best annealing temperatures in terms of lifetimes and luminescence. For example a 0.1% Er doped film is best annealed at 500 C for a period of 1 hour in an oxygen ambient atmosphere. The lifetimes measured with 0. 1% Er is around 4 ms, which is a factor of two less than as seen in fiber for ...

Measurement and Correlation of Water Adsorption Equilibria on Silica Gel, Sorbead, and Alumina Using a Novel Experimental Isotherm Apparatus DEC 97 41 pages

Authors: Scott M. Maurer; David T. Croft; David K. Friday; GUILD ASSOCIATES INC BALTIMORE MD

Full Text

The design and operation of a novel, experimental volumetric isotherm apparatus is discussed. Water adsorption equilibria in nitrogen is measured over three adsorbents: silica gel 40, alumina F-200, and sorbead RF. This work concentrated on the adsorption behavior of water at low partial pressures ranging from 1 - 1000 Pa. The isotherm data for all adsorbents studied were measured over three orders of magnitude in both loading and partial pressure ...

New Approaches to Aluminum Passivation for Corrosion Prevention 10 OCT 97 27 pages

Authors: John T. Yates Jr; PITTSBURGH UNIV PA DEPT OF CHEMISTRY

Full Text

A new method has been discovered for producing a corrosion-resistant aluminum oxide film on aluminum surfaces. The method employs the electronic activation of adsorbed water molecules on the aluminum surface, using electron- bombardment. The artificial oxide film, so produced, exhibits about 25 times higher electrical impedance using electrochemical measurements compared to aluminum oxide films made by conventional oxidation.

Tailoring of Grain Boundary Chemistry for the Development of Highly Creep Resistant Alumina 29 AUG 97 151 pages

Authors: M. P. Harmer; H. M. Chan; J. Rickman; J. Bruley; J. Cho; LEHIGH UNIV BETHLEHEM PA WHITAKER LAB

Full Text

Research has demonstrated that the controlled doping of ultra-high purity alumina with small amounts (<1000ppm) of rare earth elements, such as La and Y, dramatically lowers the sintering and creep rate. Due to the large ionic radius of the rare earth elements, rare earth elements have a low solubility in alumina and segregate strongly to the grain boundaries. Chemical composition (STEM) profiles indicate that segregation of Y and La is ...

Free Form Fabrication of Ceramics by Stereolithography 25 AUG 97 41 pages

Authors: John W. Halloran; MICHIGAN UNIV ANN ARBOR DEPT OF MATERIALS SCIENCE AND ENGINEERING

Full Text

During this grant we showed that stereolithography can directly fabricate ceramic green bodies from ultraviolet (UV) curable solutions which contain dispersed ceramic powders. We demonstrated SLA of silica, a model refractory for metal casting molds, and SLA of alumina, which is promising for structural ceramics. Viscosity control for these highly concentrated suspensions and cure depth behavior were the main issues for fabricating a ceramic using stereolithography techniques. These ceramic SLA ...

Processing of A12O3-ZrO2 Nanocomposites for Thermal Barrier Coatings 30 JUN 97 8 pages

Authors: Jackie Y. Ying; MASSACHUSETTS INST OF TECH CAMBRIDGE DEPT OF CHEMICAL ENGINEERING

Full Text

Nanocrystalline composites of Al2O3-ZrO2 have been synthesized through four different processes and evaluated in terms of their densification and ability to retain the metastable tetragonal zirconia phase. The physical stabilization of the tetragonal phase is dependent primarily on the microstructure of the material which is a strong function of the powder preparation method. Significant stabilization of the tetragonal phase after thermal treatments at 1200 deg C was achieved with the ...

Phase Stabilization of Zirconia. 30 JAN 1997 13 pages

Authors: Virgil Provenzano; Ronald L. Holtz; David Lewis; DEPARTMENT OF THE NAVY WASHINGTON DC

Full Text

Stabilized zirconia containing sintered particles of alumina and zirconia in tetragonal phase is prepared by mixing alumina particles of less than 30 nanometers with zirconia particles of less than 30 nanometers in, presence of a liquid to form a suspension, drying the suspension at a temperature up to about 600 deg C to remove the liquid and products thereof to form a dried suspension composed of agglomerated alumina and zirconia ...

Effective Medium Theory Characterization of Au/Ag Nanoalloy-Porous Alumina Composites 30 SEP 96 9 pages

Authors: G. L. Hornyak; C. J. Patrissi; C. R. Martin; J. C. Valmalette; L. Lemaire; COLORADO STATE UNIV FORT COLLINS DEPT OF ANIMAL SCIENCE

Full Text

The optical constants n sub Al and k sub Al of a 50/50 volume fraction Au / Ag alloy were derived synthetically by application of a Bruggeman (BG) effective medium expression. The alloy data base was then input into a Maxwell-Garnett (MG) effective medium expression to determine the absorption maximum of the nano-alloy/insulator composite (the volume fraction of the nano- alloy was equal to 5%). The absorption maximum (lambda max) ...

Effect of Processing Parameters on the High Temperature Creep of SiC whisker-Reinforced Alumina 27 SEP 96 8 pages

Authors: Terence G. Langdon; UNIVERSITY OF SOUTHERN CALIFORNIA LOS ANGELES

Full Text

This program investigated the role of processing on the high temperature creep behavior of polycrystalline alumina reinforced with SiC whiskers or particulates. Three types of tests were conducted. First, creep data were obtained on monolithic unreinforced alumina and on alumina composites reinforced with SiC whiskers or SiC particulates. Second, the effect of processing was investigated by testing conventionally processed composites and composites produced using a dispersion processing procedure. Third, the ...

Surface Modification of Structural Ceramics by Ion Implantation Annealing: Al2O3 and Si3N4 06 SEP 96 7 pages

Authors: Alan J. Ardell; CALIFORNIA UNIV LOS ANGELES DEPT OF MATERIALS SCIENCE AND ENGINEERING

Full Text

The near-surface regions of polycrystalline Si3N4 were modified by ion implantation and post-implantation annealing. Metallographically polished bars and disks 3 mm in diameter and ranging in thickness from 250 to 500 micrometers were implanted of co-implanted with Al(+) ,B(+) and N(+) to fluences up to 2 x 10(exp 16) ions//sq cm, using implantation energies up to 300 keV. Some of the implanted material was post-implantation annealed at temperatures in the ...

Multylayer Ceramic Composite Formation by Electrophoretic Deposition 30 JUN 96 206 pages

Authors: L. Gal-Or; S. Liubovich; M. Folman; D. Sherman; ISRAEL INST OF METALS HAIFA

Full Text

Multilayer ceramic composites are of great interest due to prospects for enhancement of fracture toughness. A novel approach to multilayer formation based on electrophoretic deposition is adopted in this work. Alternating layers of ZrO2 and Al2O3 are deposited by alternating immersion in two different suspensions. Deposition rates, green and fired densities and suspensions stability were studied as function of deposition parameters. These parameters are: electric field strength, particle concentration, deposition ...

Burning Characteristics of Individual Aluminum/Aluminum Oxide Particles 20 JUN 96 49 pages

Authors: Eric C. Ruttenberg; NAVAL POSTGRADUATE SCHOOL MONTEREY CA

Full Text

An experimental investigation was conducted in which the burning characteristics of individual aluminum/aluminum oxide particles were measured using a windowed combustion bomb at atmospheric pressure and under gravity-fall conditions. A scanning electron microscope (SEM) was used to measure the size distribution of the initial aluminum particles and the aluminum oxide residue. Analysis of the residue indicated that the mass of aluminum oxide contained in particles larger than 12 microns was ...

Melt Drawing/Coating of Oxide Fibers for Composite Materials Applications 21 MAR 1996 43 pages

Authors: J. K. Weber; J. J. Felten; P. C. Nordine; W. M. Kriven; CONTAINERLESS RESEARCH INC EVANSTON IL

Full Text

Undercooled oxide melts achieved a melt viscosity sufficient to draw mullite fibers whose chemical, microstructural, and mechanical properties were measured. Tensile strengths were 5.61 +/- 0.71 GPa (810 +/- 100 KSI) for as-drawn, amorphous fibers of 10-40 microns diameter and up to 1.0 GPa after crystallization by annealing in air. Melt drawing of YAG fibers was also demonstrated. Fiber coatings were formed by pulsed excimer laser ablation. Push-out ...

Luminescence and Gain in Co-Sputtered Al2O3 Erbium-Doped Waveguides 96 4 pages

Authors: Klein L. Johnson; Anand Gopinath; William Berglund; Ben Ellerbusch; MINNESOTA UNIV MINNEAPOLIS DEPT OF ELECTRICAL ENGINEERING

Full Text

Rare earth doping of planar waveguides may potentially yield very compact optical amplifiers, lasers, and amplified spontaneous emission light sources, as well as zero insertion loss waveguide routers, splitters, and multiplexers. Among the most developed to date are Er doped devices which emit at around 1530nm and can be pumped efficiently at 980 or 1480 nm. Interest in these devices has inspired a great deal of research into Erbium-doped thin ...

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Authors: W. Y. Lee; OAK RIDGE NATIONAL LAB TN

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Authors: Gary E. Lund; AIR FORCE INST OF TECH WRIGHT-PATTERSON AFB OH

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Solid Rocket (SRMs) that power Titan IV rockets and Space Shuttles, exhaust large quantities of potentially ozone damaging pollutants directly into the stratosphere, while in powered flight. In the past, studies on potential stratospheric impact of the exhaust products from aluminum/ammonium perchlorate based SRMs have focused on the effect of gaseous HCl from SRMs on the stratosphere. Until recently, the impact of heterogeneous chemistry on stratospheric ozone was believed to ...

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