

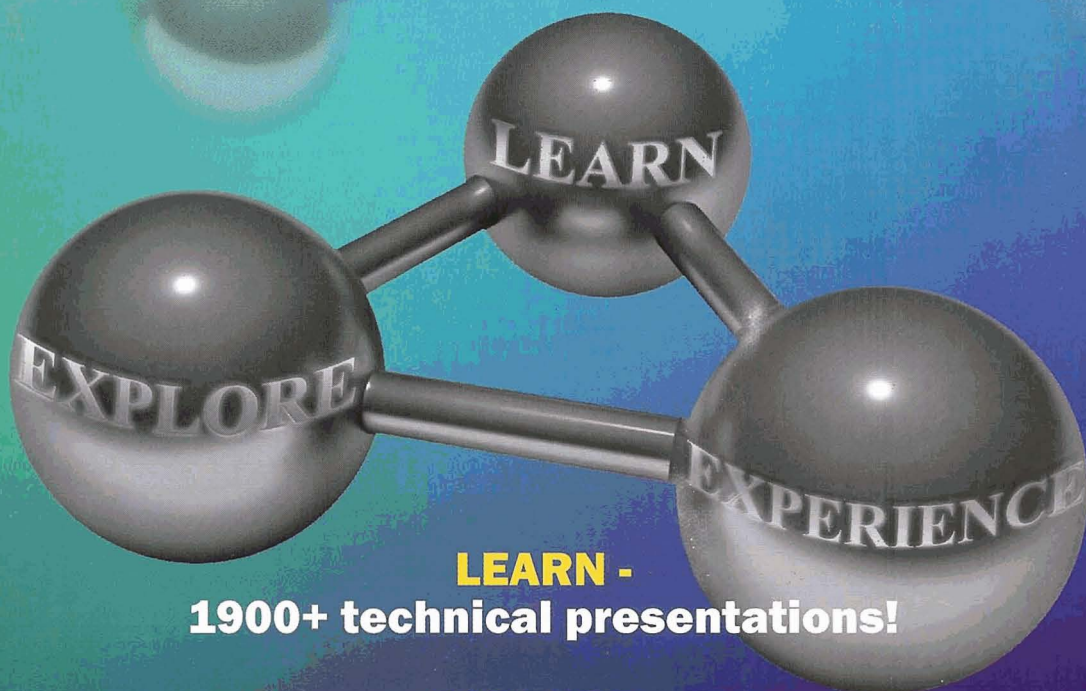
MS&T'06[®]

Materials Science & Technology
2006 Conference and Exhibition

OCTOBER
15-19, 2006
DUKE ENERGY
CENTER
CINCINNATI, OHIO

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Final Program

(Turn program over for exhibition directory.)

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11:20 AM

Sub-Critical Crack Growth Parameters and Failure Origin Analysis for a Glass-Alumina Based Low Temperature Cofired Ceramic (LTCC): *Rajan Tandon¹; Clay S. Newton¹; Christine J. Roth¹; Saundra L. Monroe¹; Jill S. Glass¹; ¹Sandia National Laboratory*

The use of low temperature cofired ceramics (LTCC) is a very attractive technology for advanced packaging. Strength values for a commercial LTCC material were measured over six orders of stressing rate magnitude in dry (0-2% RH) and wet (>98% RH) environment, using a ring-on-ring biaxial-flexure test. The inert strength of LTCC material was also obtained. Strength data were analyzed to obtain the empirical sub-critical crack (SCG) growth parameters, v_0 and n . Results are compared to values available in open literature. Testing of LTCC material with metal vias and other features led to strength decreases of as much as 50%. Fracture surface analysis results will be described. Implications of our data for safe design will be discussed. Sandia is a multi-program laboratory operated by Sandia Corporation, a Lockheed Martin Company, for the United States Department of Energy's National Nuclear Security Administration under Contract-DE-AC04-94AL85000.

11:40 AM Invited

PLZT Thin and Thick Film Development for Integrated Microsystems: *Bruce A. Tuttle¹; David Williams¹; Jim Voigt¹; Michael Niehaus¹; Joseph Cesarano¹; Paul Clem¹; Luke Brewer¹; Geoffrey Brenneka²; ¹Sandia National Laboratories; ²University of Illinois*

High energy density dielectric materials technology advances are needed to miniaturize and to integrate capacitors into electronic systems. Among the numerous capacitor dependent applications that would be benefited include inverters for fuel cell vehicles and low voltage, high speed electronics. High quality multilayer PLZT // Pt thick film capacitors have been fabricated into integrated structures by aerosol spray deposition (ASD) directly onto alumina substrates. Development of direct write, ASD techniques to co-sinter dense PLZT and Pt layers is presented. Our developments resulted in the fabrication of multilayer ceramic capacitors containing up to 9 layers. For low voltage applications, multilayer, chemical solution deposited lead lanthanum zirconate titanate (PLZT) films were fabricated and characterized to maximize energy density and to minimize capacitor volume. Sandia is a multiprogram Laboratory operated by Sandia Corporation, a Lockheed Martin Company, for the U.S. Department of Energy's National Nuclear Security Administration under contract DE-ACO4 - 94AL85000.

12:20 PM

Electroluminescent Devices with Amorphous Diamond Electrode: *Jui-Chen Pu¹; Sea-Fue Wang¹; James C. Sung¹; ¹Department of Materials and Mineral Resources Engineering, National Taipei University of Technology*

The amorphous diamond film was used as the electrode for electroluminescent (EL) device. The amorphous diamond film, prepared by arc physical vapor deposition (PVD), has preferred electric conduction and negative electron affinity when used as electrode. The phosphors layer contains ZnS powder and binder was screen-printed. The performance of electroluminescent device with amorphous diamond electrode (DEL) was evaluated and compared with that used aluminum film as electrode. The DEL, evaluated under 50 V at 60 Hz (AC), possesses excellent turn-on threshold electroluminescence behavior. It was found that the brightness is better than that of device with aluminum electrode. The energy barrier for electrons to emit from the electrode can be greatly decreased. The amorphous diamond film can be used to generate a bright light with a high energy efficiency. Also the decay rate of luminosity is slower than those use aluminum film electrode.

12:40 PM

Characteristics of Al-Epoxy Composite as Backing Material in an Ultrasonic Transducer: *Anucha Ruangsawad¹; Sirithan Jiemsirilerts¹; Pitak Laoratanakul²; ¹Chulalongkorn University; ²National Metal and Materials Technology Center*

A backing composite in an ultrasonic transducer has been successfully fabricated from epoxy resin associated with metal (aluminium) powder, silane coupling agent and plasticizer. The influences of Al content on sound velocity, acoustic impedance and attenuation of the backing material were investigated. High acoustic impedance and attenuation of epoxy composite are expected to be useful for ultrasonic system. Ultrasonic transducers for measurement

systems are required having a capability of generating a short time waveform ultrasonic pulse and broadband frequency spectrum. The single-element piezoelectric transducers with suitable Al-epoxy composite backing materials were fabricated and their ultrasonic performances were examined. It has been found that the ultrasonic transducer with Al-epoxy composite backing layer generates an ultrasonic wave with broadband frequency spectrum and short time waveform pulse.

Ion Beam Modification and Synthesis in Solids: Plasma Processing for Biology, Medicine and Tribology

Program Organizers: Vaithiyalingam Shutthanandan, Pacific Northwest National Laboratory; Yanwen Zhang, Pacific Northwest National Laboratory; Richard J. Smith, Montana State University

Wednesday AM

October 18, 2006

Room: 264W

Location: Duke Energy Center

Session Chair: Richard J. Smith, Montana State University

8:30 AM Introductory Comments

8:40 AM Keynote

Bioactivity of Plasma Surface Modified Biomaterials: *Paul K. Chu¹; ¹City University of Hong Kong*

Plasma surface modification is an effective and economical surface treatment technique for many biomaterials. The technique offers the unique advantage that the surface properties and biocompatibility can be enhanced selectively while the favorable bulk characteristics of the materials remain unchanged. Existing materials can thus be used and needs for new classes of materials may be obviated thereby shortening the time to develop novel and better biomedical implants. Recent work conducted in our laboratory pertaining to the improvement of surface bioactivity and properties of different types of biomaterials will be presented in this invited talk. We have used plasma technology to treat polymers to improve the surface antibacterial properties of the materials and improve the biocompatibility of novel orthopedic biomaterials such as NiTi shape memory alloys. Our work on the enhancement of surface bioactivity of nano-structured ceramics coatings using plasma surface treatment and UV irradiation will be presented.

9:40 AM Invited

Application of Ion Beam Technology for Alternative Bearing Surfaces in Total Joint Arthroplasty: *Fereydoon Namavar¹; Shailaja Varma¹; Hani Haider¹; Kevin L. Garvin¹; ¹University of Nebraska Medical Center*

Artificial total joint replacements (TJA) are commonly used in hips and knees (over 500,000/yr in the USA alone), frequently used in shoulders, and recently approved for artificial spinal discs. Joint implants have articulating surfaces in various configurations of metal-polyethylene, metal-metal, ceramic-polyethylene, etc. While these implants relieve pain and increase function, they are susceptible to both adhesive and abrasive wear, wear particles and osteolytic effect. Because the lifetime of these implants is about 10-15 years they are not adequately durable for the younger, more active, or heavier patients; this results in revision surgery which is generally less successful than the primary surgery. If the life of these implants can be increased, patient suffering and medical bills can be reduced. This presentation addresses the development of required ultra-hydrophilic hard nanocrystalline coatings by ion-beam-assisted deposition to integrate the favorable wear and friction characteristics of nano-ceramics with the inherent ductility and reliability of metal.

10:20 AM Break

10:40 AM Invited

Large Area Filtered Plasma Assisted Ion Deposition Technologies: *Vladimir Gorokhovskiy¹; ¹Arcomac Surface Engineering LLC*

Filtered arc plasma provides fully atomized and near 100% ionized metal-gaseous vapor plasma. These parameters are favorable for a variety of plasma