

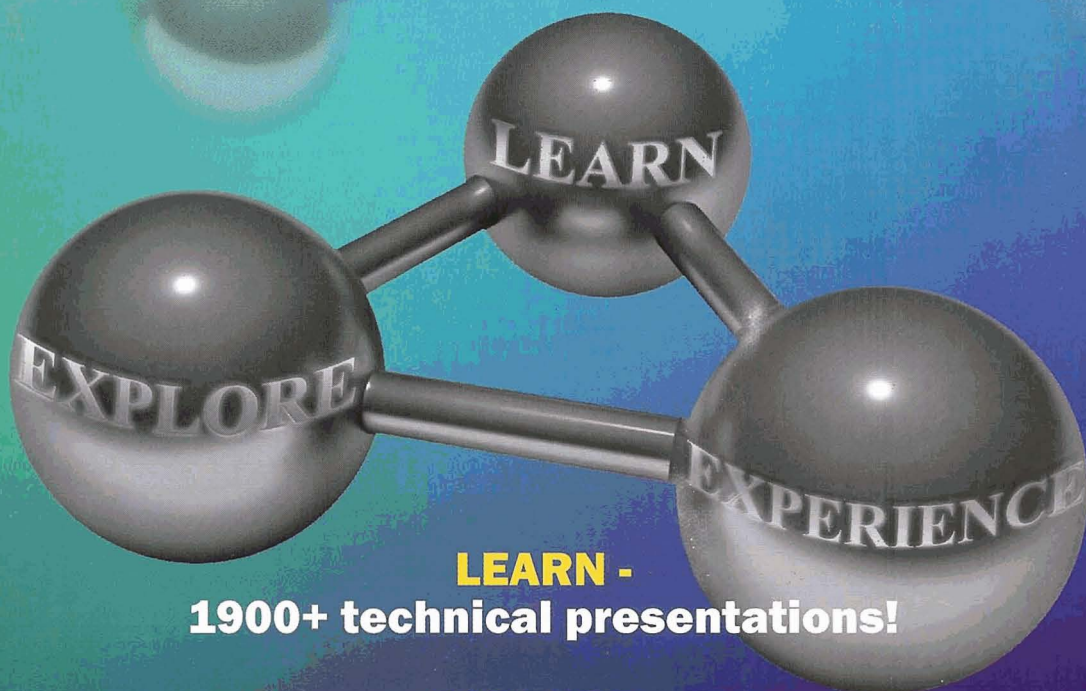
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the mechanical properties of material is one of the most challenging issues. Six kinds of single crystal silicon micro beams fixed on both ends with trapezoidal cross section were fabricated using photolithography technology, with dimensions of 150-1000 μm , 16-60 μm wide, 6 and 20 μm thick. The micro beam specimens were used in bending test by nano indentation method. Results show that the mean values of bending strength increase with the ratio of surface area to volume, varying from 3.24 to 10.15Gpa, based on weibull analysis shape parameters are 4.21-10.54 while scale parameters under the fracture probability of 65.4% vary from 3.26 to 10.26Gpa, both the average bending strength and weibull parameters display strong size effects. Finally, the data obtained from bending test could be used in reliability design of single crystal silicon micro devices.

Strain at Nanoparticle Contacts: *Julia Deneen¹; William M. Mook¹; William W. Gerberich¹; C. Barry Carter¹;* ¹University of Minnesota

Understanding the origin of stresses at nanoscale contacts is crucial as nanoparticles find use in various applications where adhesion and wear are important. This study uses transmission electron microscopy (TEM) to investigate the strain fields created by contacting nanoparticles. When two particles come in contact with one another it is energetically favorable for them to meet at an area rather than at a point, forming a "nano grain-boundary". In this zero-load situation the stress is balanced by a compressive stress at the center of the contact and a tensile stress at the exterior. The strain at the interface can be imaged in the TEM due to bent lattice planes which cause a local change in the diffraction conditions. This study uses the TEM to examine the strain fields present, the relationship of twin boundaries to the particle-particle contacts and the orientation relationship of the two particles across the "grain boundary".

Nanostructured Materials: Synthesis, Characterization and Applications

Effects of Surface Modification on Conductivity and Sensing Properties of Individual SnO₂ Nanowires: *Suhua Luo¹; Paul K. Chu¹; Weili Liu²; Maio Zhang²; Chengdu Lin²;* ¹City University of Hong Kong; ²Shanghai Institute of Microsystem and Information Technology

Rutile (110) tin dioxide nanowires were synthesized by thermal oxidation of tin powders. The I-V characteristics of a single as-grown SnO₂ showed weak nonlinearity in air. The sample annealed in vacuum and O₂ showed different properties, and a nearly ohmic behavior was obtained in the sample annealed in vacuum indicating the increase in surface conductivity. The current in the sample annealed in O₂ was slightly smaller than that in the as-grown one and significantly smaller than that of the vacuum-annealed one. The sensitivity on ethanol was evaluated using different ethanol concentrations of 10, 30, and 50 ppm. The current in all three samples decreased with increasing ethanol concentration with the sample annealed in vacuum exhibiting the most obvious decrease. The different potential barrier height at the surface of the SnO₂ nanowire after annealing in different ambients may explain the results in the shift of the breakdown voltage.

Fabrication of Meso-Scale Nanocrystalline Metal Components by Wire EDM: *Pin Yang¹; Paul G. Kotula¹; Michael P. Saavedra¹; Srinivasan Chandrasekar²;* ¹Sandia National Laboratories; ²Purdue University

Literature has shown that nanocrystalline metals have superior hardness, strength, ductility and wear as compared to conventional metals. Previous studies performed at Purdue University have shown that a severely plastic deformed of Inconel 718 alloy consists nanocrystalline structure. Despite a significant microstrain existing in the metal, microstructural coarsening or recrystallization was not observed after material had been annealed at 600°C more than 1000 hours. In this investigation, we will study and compare the microstructure and mechanical properties of the stock and the nanostructured Inconel 718 alloy. Meso-scale components will be fabricated by wire EDM, with minimum features of 40 to 50 μm . Structural change induced by EDM will be evaluated by TEM. The mechanical performance and fracture behavior of a mesoscale cantilever structure with beam size close to the grain size of stock material will be studied and compared with the same structure fabricated from nanocrystalline material.

Growth of Nano-Grained Indium Thin Films and Their Optical Properties: *Jung-Hyun Park¹; Raj Korde²; Dong-Joo Kim¹;* ¹Materials Research and Education Center, Auburn University; ²International Radiation Detectors Inc.

Since the performance of polycrystalline thin films strongly depends upon real structure, atomic-scale control and manipulation of the polycrystalline thin film structure via kinetically limited low-temperature deposition has been focused on materials science during the past decades. In this study, indium films were investigated for the narrow band filter with passband (760 ~1120°C), and with highly selected visible light blocking. Indium and indium-based alloy films were deposited on amorphous substrate by sputter deposition at both room temperature and liquid nitrogen temperature. Investigation of process parameters was performed with an emphasis on deposition rate and substrate temperature to correlate film structure and deposition parameters. Average grain size was controlled ranging from tens of nanometer to few micrometer. Characterization of indium films exhibits potentials for nanostructural engineering for specific optical applications and leads to refinement of structure zone models of low melting temperature metals.

Poly(Vinyl Alcohol) Hydrogels Based Membranes – Synthesis, Sorption and Diffusion Studies: *Adina S. Papancea¹; Silvia F. C. Patachia¹; Artur J. M. Valente²; Claudia Baciu Florea¹;* ¹Transilvania University of Brasov; ²University of Coimbra

Late or selective diffusion through polymeric membranes has various applications in separation processes, environmental protection, pharmaceuticals for drug delivery systems, etc. Porous PVA hydrogel membranes have been obtained by repeated cycles of PVA solution's freezing and thawing. These membranes have been modified by chemical reactions (oxidation and complexation) or by physical methods (blending with natural products). Behaviour of these membranes in different electrolyte solutions has been studied in terms of electrolytes-PVA interactions. The influence of different parameters of membranes synthesis on their permittivity has been studied. The ions diffusion has been tested by using conductivity, potentiometry and flam photometry measurements and the membrane permittivity has been calculated for every ionic species. The obtained information could be used to create electrolytes sensors, to tailor membranes permittivity for different ions from waste waters in order to its purification and to create effective systems for control drugs delivery.

Synthesis and Characterization of (AlMg)B₂ Composites and Nanocomposites under Vacuum: *Luvina Reyes Russ¹; Marcelo Suarez¹;* ¹University of Puerto Rico

Exploring the potential applications of MgB₂ superconductor as a reinforcement for wear, creep resistance when alloyed with Al. MgB₂ density is comparable to Al, so its composite will become a new lightweight material. From aluminum matrix composites (AMC's) and its ternary system Al-Mg-B, the main purpose of this research is to develop the procedure to synthesize and characterization of particles and nanoparticles AlB₂, or ternary diboride (Al,Mg)B, formed under vacuum. Phase changes occur without reaching the boron melting point. Ball milling process was introduced in this research due to the difficult of mixing and melting Al 90% (pure) and MgB₂ 10% (powder). By this technique wettability was possible between the alloy components. Then samples have been melted in Arc Furnace under vacuum. The system Al+MgB₂ has been started to be characterized by Microscopy, SEM, TGA/SDTA, XRD, AFM, mainly.

Thermal Stability Studies of Self-Assembled Arrays of Gold Nanoparticles: *Patrick Clasen¹; Shuailei Ma¹; Roger Ristau¹; Martin P. Harmer¹; Christopher J. Kiely¹;* ¹Lehigh University

Since the realization that nanoparticles can exhibit unusual size-dependant properties, there has been considerable interest in using these particles as the building blocks for new 'bulk' materials with novel characteristics. Our research effort revolves around using the chemical interactions between ligand stabilized gold nanoparticles to self-assemble into 1D strings, 2D rafts and 3D supercrystals. In this presentation we will demonstrate how varying certain parameters can fundamentally affect the sintering mechanism (i.e. coarsening versus densification) and the sintering kinetics of ligand stabilized gold nanoparticle arrays. In particular, the effects of (i) particle size, (ii) particle