SYMPOSIUM X

Frontiers of Materials Research

November 27 – 30, 2000

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* Invited paper

This symposium is the Society's principal vehicle to maintain the interdisciplinary and integrative nature of its mission within the materials community with invited reviews presented over the lunch hour. Leaders in various specialties represented by the topical symposia present reviews designed for materials researchers who are **NOT** specialists in the reviewed field.

SESSION X1:
Chairs: Sungho Jin, Antonios G. Mikos, David J. Srolovitz and Bernd Stritzker
Monday Afternoon, November 27, 2000
Room 302 (Hynes)

12:05 PM *X1.1
THE ROMANCE AND REALITY OF FORENSIC TRACE EVIDENCE ANALYSIS. David Stoney, McCrone Research Institute, Chicago, IL.

ABSTRACT NOT AVAILABLE.

12:45 PM *X1.2
MICROMACHINES AND THE FUTURE OF OPTICAL NETWORKS. Randy C. Giles, Lucent Technologies, Holmdel, NJ.

ABSTRACT NOT AVAILABLE

SESSION X2:
Chairs: Sungho Jin, Antonios G. Mikos, David J. Srolovitz and Bernd Stritzker
Tuesday Afternoon, November 28, 2000
Room 302 (Hynes)

12:05 PM *X2.1

MRS MEDAL AWARD TALK PRESENTATION

FUTURE MATERIALS AND SELF ASSEMBLERS. S.I. Stupp, Department of MS&E, Department of Chemistry, and Medical School, Northwestern University, Evanston, IL.

An important goal for materials science is learning to program molecules for self assembly over multiple length scales to create functional materials. The development of this field will eventually yield new capabilities to design the properties of soft matter and control its patterning with nanoscale features. Such advances on the control of molecular self assemblers can enable many new technologies, including those that will interface with biology and medicine. This lecture will describe the assembly of molecules into supramolecular structures less than 10 nanometers in size which then self organize to form films that integrate properties such nonlinear optical susceptibility, luminescence, and piezoelectricity. In a different example, molecular self assemblers are shown to build a scaffold of one dimensional structures which enhances the mechanical orientation of polymers. Lastly, self assembling biomaterials for biomedical or biotechnological systems are described that have the capacity to promote or suppress the adhesion of cells, or release nanostructures that travel to cell nuclei.

12:45 PM *X2.2

MRS MEDAL AWARD TALK PRESENTATION

ULTRANANOCRYSTALLINE DIAMOND IN THE LABORATORY AND IN THE COSMOS. Dieter M. Gruen, Materials Science and Chemistry Divisions, Argonne National Laboratory, Argonne, IL.

The synthesis of ultrananocrystalline diamond films from carbon containing noble gas plasmas will be discussed. The ultrananocrystallinity is the result of new growth and nucleation mechanisms, which involve the insertion of C2, carbon dimer, into carbon-carbon and carbon-hydrogen bonds, resulting in hetereogeneous nucleation rates on the order 1010 cm-2 s-1. Extensive characterization studies lead to the conclusion that phase-pure diamond is produced with a microstructure consisting of randomly oriented 3-10-nm crystallites.
By adjusting the noble gas/hydrogen ratio in the gas mixture, a continuous transition from micro- to ultrananocrystallinity is achieved. Up to 10% of the total carbon in the ultrananocrystalline films is located at 2- to 4-atom-wide grain boundaries. Because the grain boundary carbon largely is π-bonded, the mechanical, electrical, and optical properties of these films are profoundly altered. Ultranocrystalline diamond films are unique new materials with applications in fields as diverse as tribology, cold cathodes, corrosion resistance, electrochemical electrodes, as well as SAW and MEMS devices.
Ultrananocrystalline diamond is of particular interest because it occurs in primitive carbonaceous chondrites and possibly in the interstellar medium and the outer planets. The mechanism of condensation of carbon in the envelopes of AGB stars and supernovae has been discussed extensively in the literature on the basis of traditional diamond CVD synthesis. Here it is pointed out that the relatively recent identification of a number of stellar objects rich in C2 (and possibly He) suggests that the C2 mechanism for diamond synthesis may, in fact, operate in the cosmos.
Work supported by the U.S. Department of Energy, BES-Materials Sciences, under Contract W-31-109-ENG-38.

SESSION X3:
Chairs: Sungho Jin, Antonios G. Mikos, David J. Srolovitz and Bernd Stritzker
Wednesday Afternoon, November 29, 2000
Room 302 (Hynes)

12:05 PM *X3.1
NEW DIRECTIONS FOR BIOMATERIALS RESEARCH. Rena Bizios, Rensselaer Polytechnic Institute, Dept. of Biomedical Engineering, Troy, NY.

ABSTRACT NOT AVAILABLE

12:45 PM *X3.2
IMPACT OF BIOMATERIALS RESEARCH ON TISSUE ENGINEERING. Charles A. Vacanti, University of Massachusetts Medical Center, Department of Tissue Engineering, Worcester, MA.

ABSTRACT NOT AVAILABLE

SESSION X4:
Chairs: Sungho Jin, Antonios G. Mikos, David J. Srolovitz and Bernd Stritzker
Thursday Afternoon, November 30, 2000
Room 302 (Hynes)

12:05 PM *X4.1

TURNBULL AWARD LECTURER PRESENTATION

MULTIFUNCTIONAL MATERIALS: WHAT ARE THEY AND WHAT ARE THEY USEFUL FOR? Anthony G. Evans, Princeton University, Princeton, NJ.

ABSTRACT NOT AVAILABLE

BOX LUNCHES AVAILABLE AT THE DOOR