Wednesday Morning, November 5, 2003

AVS 50th Anniversary Plenary Session
Room 310 - Session AP-WeM

Surfaces, Processing, and Materials

Moderator: J.H. Weaver, University of Illinois at Urbana-Champaign

8:20am **AP-WeM1 Controlling Surface Reactions***, **G. Ertl,*** Fritz-Haber-Institut der Max-Planck-Gesellschaft, Germany **INVITED**

Reactions at solid surfaces determine the mechanisms of heterogeneous catalysis and form hence the basis of numerous technologically important processes. Studies with well-defined surfaces enable detailed insights into the underlying elementary steps and their control down to atomic length and femtosecond time scales. Nonlinear kinetics coupled to adsorbate diffusion may give rise to phenomena of spatio-temporal self-organisation which may be affected by various feedback strategies. In this way not only options for improving catalytic activity, but also models for structure formation in living systems are established.

9:00am **AP-WeM3 Continuity in Plasma Processing: Yesterday's Accomplishments, Today's Innovations and Tomorrow's Challenges@footnote 1@***, **M.J. Kushner,*** University of Illinois, Urbana-Champaign **INVITED**

Plasma processing has provided impressive capabilities for converting either inert or weakly reactive materials into activated species which produce light, modify or create materials or activate other processes. The impact of plasma processing for modification of high technology materials owes its success, in part, to a legacy of research on what at first look seems like unrelated topics, such as lighting, lasers and upper atmospheric physics. These projects created a continuity of knowledgebases of experimental and computational techniques and fundametal data which have provided the foundation for today's advances in plasma based technologies. For example, advanced microdischarge plasma sources such as plasma display panels can trace their origins to dielectric barrier discharges for ozonizers. This legacy of "continuity," leveraging knowledge bases to move forward plasma based technologies, provides insights to how plasmas will impact future high technology applications in microelectronics fabrication, sensors, biotechnology, lighting, and materials processing. That continuity and expectations for future developments in the field will be discussed. @FootnoteText@ @footnote 1@ Work supported by the National Science Foundation, Semiconductor Research Corporation, 3M Inc. and AFOSR.

9:40am **AP-WeM5 The Promise of Solid State Lighting: Status, Trends, and Remaining Challenges***, **M.G. Craford,*** Lumileds Lighting **INVITED**

LED technology developments over the past decade have enabled the use of LEDs in a variety of colored and white lighting applications. With further improvement LEDs appear to have the potential to become an important technology for large area general illumination. White LEDs with outputs of more tha 100 lumens are already available commercially. LEDs are expected to save energy, be environmentally friendly, and provide a variety of other features, including long lifetime, compact size, and programmable color control, which enable design options for new approaches to lighting. In this presentation the LED technology status and trends will be described and LEDs will be compared to conventional lighting technologies. Developments that will need to occur for LEDs to be a viable contender for large area general illumination will be discussed.

10:20am **AP-WeM7 Epitaxial Ferromagnetic Heterostructures Based on Semiconductors: Towards a New Spin-Based Electronics***, **M. Tanaka,*** University of Tokyo, Japan **INVITED**

Creating a new spin-based electronics (often called "spin-electronics" or "spintronics") is one of the hot topics in the current solid-state physics and electronics research. In order to utilize the spin degree of freedom in solids, particularly in semiconductors the current electronics is based on, we need to fabricate appropriate materials, understand the spin-dependent phenomena, and control the spins. In this talk, I will review the recent developments of epitaxial ferromagnetic heterostructures based on semiconductors towards spintronics. This includes the semiconductor materials and heterostructures having high ferromagnetic transition temperature (III-V based alloy magnetic semiconductors, Mn-delta-doped magnetic semiconductors, and related heterostructures), spin-dependent transport and tunneling, spin-dependent bandgap engineering, their device applications (tunneling magnetoresistance devices and three-terminal devices). Future issues and prospects will be also discussed. @FootnoteText@ The author thanks the collaborations and discussions with S. Sugahara, A.M. Nazmul and Y. Higo, S. Ohya, and T. Matsuno. The work at the Univ. of Tokyo was partially supported by PRESTO of JST, IT Program of MEXT, Toray Science Foundation.

Author Index

Bold page numbers indicate presenter