

**MECHANICAL ENGINEERING DEPARTMENT
ME/IE 8773-8774**

THERMODYNAMICS AND HEAT TRANSFER DEPARTMENT SERIES

Topic: PLASMA TECHNOLOGY

Host: Joachim V.R. Heberlein

**Plasma-Surface Interaction: In Situ and Real Time Studies
During Plasma Processing of Materials**

by

Richard van de Sanden

Professor, Department of Applied Physics

Eindhoven University of Technology,

P.O.Box 513, 5600 MB Eindhoven, The Netherlands

m.c.m.v.d.sanden@tue.nl

Wednesday, March 22, 2006

3:30-5:00 p.m.

Room 1130 ME

Coffee and refreshments will be available at 3:15 p.m. in Room 1130 ME before the seminar

ABSTRACT — The challenge in the application of plasma enhanced chemical deposition techniques, as for example required for the introduction of thin film solar cells as a reliable and sustainable energy source for the future, is how to achieve the combination of high deposition rates and good quality material. A profound knowledge of the plasma chemistry aspects in relation to the thin film formation mechanisms is therefore essential. In this talk I will review our approach to study in situ and in real time the surface kinetic processes occurring during plasma deposition and etching. We have chosen for a photon-in-photon-out approach and have developed novel ultra sensitive techniques to unravel the radical- and ion-surface interactions. I will discuss specifically the techniques of evanescent wave cavity ring down spectroscopy, second harmonic generation and spectroscopic ellipsometry which in combination with gas phase diagnostics such as cavity ring down spectroscopy and threshold ionization mass spectrometry provide a unique possibility to understand the surface kinetic processes. These studies enable the manipulation of the plasma properties to obtain specific material applications. Examples include the understanding of the plasma oxidation of ultra-thin aluminum films for magnetic tunnel junctions, the deposition of dense barrier layers for plastic electronics applications and the high rate deposition of surface and bulk passivating films for multi-crystalline solar cells.

BIO — Richard van de Sanden is a full professor at the Department of Applied Physics of the Eindhoven University of Technology in the Netherlands. He received his PhD in 1991 from the Eindhoven University on the topic of the fundamental investigation of an expanding plasma jet. In 1990 he was appointed as an assistant professor, his main interest being the fundamentals of plasma-enhanced deposition and etching. During 1992-1997 he was a research fellow of the Royal Netherlands Academy of Arts and Sciences. In 1993 he was on sabbatical leave at AT&T Bell labs. He has worked since then on fast plasma deposition technology focusing on the fundamentals of both plasma as well as the surface processes occurring during growth in particular on applying new advanced diagnostics for gas phase species detection as well as in situ analysis of the physical and chemical properties of the growing film. In 2000 he was a visiting professor at the University of California (Santa Barbara). In that same year he was appointed as a full professor at the Eindhoven University of Technology. He has consulted for several companies (General Electric, Fuji Photofilm, Novellus, BOC Edwards) on plasma and thin film deposition technologies. He is a member of the AVS and MRS and has served as program chair for the Thin Film Division in 2000 and 2002. He is on the editorial board of Plasma Sources: Science and Technology and Plasma Processes and Polymers. He is a fellow of the IUPAC and IOP and serves on numerous scientific committees of international conferences. He is the European regional editor of Plasma Sources: Science and Technology. He has authored and co-authored over 100 papers in peer-reviewed journals and is the co-inventor of 10 patents.

Informal Faculty Luncheon: Wednesday, March 22, 2006, 12:00 noon. Meet in 1100 ME and walk to lunch with other faculty. Dr. van de Sanden will be able to attend.