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Distinguished Lecture Series

Semiconductor Defect Engineering for Nanoelectronics

Tuesday, 11 December 2012
1:00 pm
Fusionopolis, #17-01, Connexis SOUTH Tower
Charles Babbage Room

Edmund G. Seebauer
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About the speaker:

Edmund Seebauer is the James W. Westwater Professor of Chemical & Biomolecular Engineering, where he served as department head for six years until 2011. Illinois' first multi-institutional PhD program (with the National University of Singapore) was initiated during his headship.

Professor Seebauer's research focuses on the control of defect behavior in semiconducting materials to make nanoscale devices of interest in microelectronics, energy and environment applications. Much of the work employs defect engineering to tailor the properties of semiconducting oxides as catalysts for fuel cells, combustion effluents, and environmental remediation.

Professor Seebauer has received a Sloan Research Fellowship in Chemistry and an Inventor Recognition Award from Semiconductor Research Corporation, and is a Fellow of the American Association for the Advancement of Science, the American Institute of Chemical Engineers, the American Physical Society and the American Vacuum Society. He has approximately 175 journal and conference publications, and has co-authored books on charged defects in semiconductors as well as engineering ethics. Professor Seebauer has received several awards for student teaching and advising.

Abstract:

Progression of Si-based device processing ever deeper into nanoscale dimensions is creating stiffer challenges for the control and manipulation of atomic-scale defects. For example, the increasing use of multiple chemical elements, either as part of the semiconductor matrix (*e.g.*, Si-Ge) or in doping cocktails (*e.g.*, C, F, N) creates a much more complicated network of defect reactions. The growing surface-to-volume ratios that stem from device shrinkage accentuate the importance of defect interactions with surfaces and interfaces, even though the understanding of these interactions remains in embryonic stages. And previously unrecognized effects of temperature on defect creation during ion implantation, as well as of photostimulated defect diffusion during annealing, manifest themselves more clearly in the nanoscale regime. The present work briefly describes these various phenomena, and makes the case that multiscale modeling of defect behavior through a combination of quantum calculations, molecular dynamics, Monte Carlo, and continuum simulations – closely coupled with suitably designed experiments – has become ever more integral to effective defect engineering.