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Study of low density sites on silicon dioxide surfaces using fluorescent probes and the role of these sites in nucleation of semiconductor and metal films

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Characterization of low density sites on planar oxide surfaces remains a challenging task. Such sites are believed to play an important role in catalysis and particle/film nucleation, although the inability to directly observe these sites limits our understanding of these processes. We have developed a technique that enables detection of low density sites on planar surfaces using fluorescent probe molecules. Derivatives of perylene, a high quantum yield fluorophore, with various functional groups were used to titrate surface sites in vacuum. The functional group was chosen to chemically bind to the desired site and *in situ* photoluminescence (PL) measurements were used to determine the density of sites and learn about their distribution. An estimated detection limit of <10^{10} sites/cm^2 is possible with this technique. We shall discuss our work using fluorescent probes to study sites on the silica surface. In particular, results of our studies of strained siloxane (density~10^{12} cm^{-2}) with perylene-3-methanamine and oxygen vacancy defect (OVD) sites (density~10^{11} cm^{-2}) with 3-vinyl perylene will be presented. Particle nucleation on oxides is suspected to involve defects that trap adatoms and form critical nuclei. Using this technique, the role strained siloxane and oxygen vacancy sites play in trapping adatoms during the nucleation of germanium and ruthenium particles on silica surfaces is examined.

Biography

John G Ekerdt earned his PhD from the Univerisity of California, Berkeley in 1979. He is currently working as the Associate Dean for Research in Engineering and the Dick Rothwell Endowed Chair in Chemical Engineering at the University of Texas at Austin. He has more than 300 refereed publications, two books and seven US patents. His current research interests focus on the surface, growth and materials chemistry of metal, dielectric and perovskite films and nanostructures by developing and understanding the reactions and chemistry that control nucleation and growth of films and nanostructures.

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