Electron Transfer Through Self-assembled Alkyl Monolayers on Si(111)

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Over the last decade there has been increasing awareness of the opportunities presented by the convergence of surface science and organic chemistry. This work is underpinning the development of revolutionary concepts for the design of molecular scale devices and for the integration of solid state, inorganic structures with biologically active interfaces. Although the reactions of organic molecules with silicon surfaces are not new, this area which traditionally has been dominated by physical scientists, has increasingly been influenced by organic and bioorganic chemists. This organic perspective has brought new levels of complexity of structure and function and greater understanding of the molecular basis of reactivity.

Much of the work so far has focused on exploring the scope of the chemistry and on understanding the structure and quality of the organic-silicon interfaces. We have studied reactions of hydrogen terminated silicon as a means to form monolayer thick alkyl films on the Si(111) surface. More recently, we have begun to focus on strategies to pattern silicon surfaces simple organic molecules, polymers and with biologically active molecules such as proteins and DNA. We have developed simple chemical approaches to introduce essentially any chemical function at the ends of Si-alkyl monolayers. Optical and electrochemical studies suggest a new approach to chemical sensing at organic/silicon interfaces that may obviate the need for commonly used fluorescent labels.