Chemical Modification of Silicon Surfaces Through Functionalization with Novel Diruthenium Molecules

Jennifer Verduzco, Steven Cummings, Julia Savchenko, Lon Porter, and Tong Ren*

Department of Chemistry, Purdue University, West Lafayette, IN 47907-2084

Covalent functionalization of silicon surfaces, through formation of C-Si bonds, is emerging as an important area in the development of new semiconductor hybrid materials for use in microelectronics, photovoltaics, and sensing applications.[1,2] The objective of this research is the preparation of diruthenium functionalized Si surfaces and the subsequent tailoring of interface properties for use in photovoltaic cells and microelectronic devices.

The Si surface can be chemically passivated with hydrides to prevent substrate oxidation and as a starting point for further chemical modification. Subsequent surface modifications can be made on the H-passivated Si surface through reactions with terminal olefins and diruthenium molecules. This research has focused on the synthesis of these molecules and the subsequent functionalization of Si(111) and porous Si(100) surfaces through photochemical and wet chemical techniques.

Successful deposition of 1-decene, 10-undecylenic acid, and $Ru_2(D(3,5\text{-}Cl_2Ph)F)_3(\mu\text{-}CCH2CH2CH_2CH{=}CH2)Cl$ moieties on Si(111) and $Ru_2(DmAniF)_3(\mu\text{-}O_2CH(CH_2)_8CH{=}CH_2)Cl$ on porous Si(100) was achieved through microwave and thermal heating methods. These diruthenium functionalized surfaces will be used to study the charge transfer at the molecular semiconductor junction and also the capacity of molecular spin to modulate the current of semiconductor channels.

References:

(1) Bent, S. F., *Surface Sci.* **2002,** *500*, 879.

(2) Buriak, J. M., *Chem. Commun.* **1999**, 1051.