HARRICK SCIENTIFIC PRODUCTS

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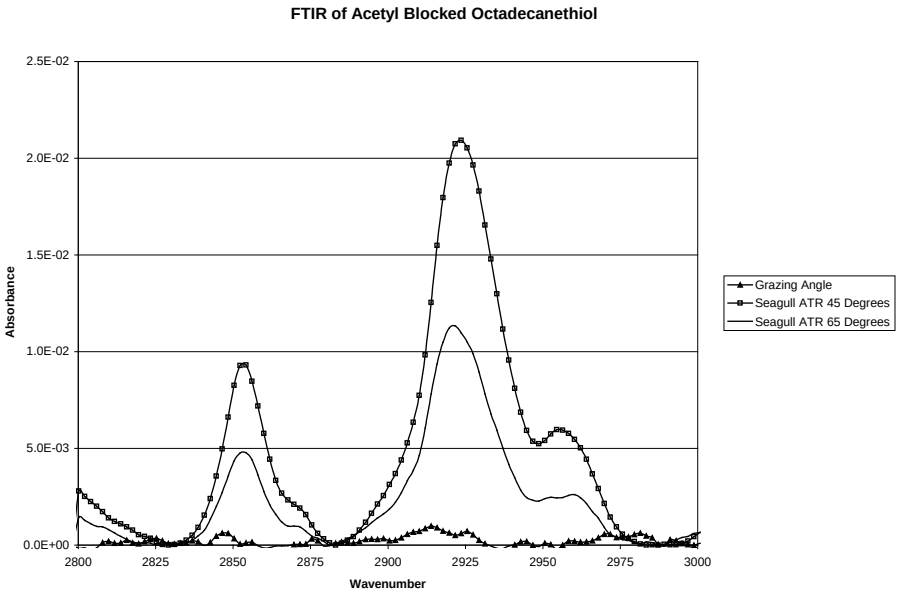
# SELECTIVE ATTACHMENT OF MOLECULAR WIRES

The Seagull Variable Angle Reflectance Accessory.

The advancement of nanoscale technology depends on the ability to link nanostructures to the outside world in a precise and stable manner. Different techniques have been used to achieve this, including bonding dithiolated molecules into break junctions,[1] contacting two monolayers together with a mercury drop electrode,[2] and most recently, chemically bonding metal contacts to the ends of a symmetric dithiol molecule.[3] As soon as more complicated molecular electronic components are created, for example a single-molecule field effect transistor, selective attachment of molecular wires to specific electrodes will be necessary. Since thiols have such a high affinity for gold, they are a good choice for chemically bonding molecular electronic components to a gold conductor. A blocking group mounted on the thiol head that could prevent its adsorption onto gold until the group is intentionally removed would be extremely valuable and could enable selective attachment.

Using octadecanethiol as a model, acetyl and benzoyl blocking groups have been found to inhibit adsorption of dialkyl thiols, but not completely prevent it. The general procedure for creating the alkanethiol self assembled monolayers (SAM) is straightforward, a gold substrate is submerged into a 1 mM solution of the desired thiol in THF overnight. The sample is then rinsed with excess THF and dried under argon before the quality of the SAM formed is assessed through ellipsometry and FTIR measurements.

Below are examples of FTIR measurements of SAM's formed from acetyl and benzoyl blocked octadecanethiol using two different techniques. The collection parameters for all three spectra are the same and it can be noted that the SAM's are barely visible using typical grazing angle reflectance. Using the Seagull with a Ge crystal though, the SAM's are easily detected with peaks around 2917 and 2850 $cm^{-1}$ attributed to the $CH_2$ groups in the alkyl chain and peaks at 2965 and 2877 $cm^{-1}$ attributed to the $CH_3$ group. The variable angle allows the optimization of the angle for the best sensitivity of the films that in this case is 65 degrees.




applications note

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[1] Reed, M. A. ; Zhou, C. ; Muller,C. J.; Burgin, T. P. ; Tour,J. M. *Science*, **1997**, 278, 252.
[2] Holmlin, R. et al., *J. Am. Chem. Soc.*, **2001**, 123, 5075.
[3] X. D. Cui, et at., *Science*, **2001**, 294, 571.