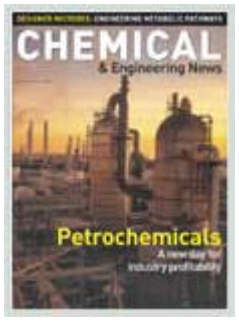


Latest News

March 21, 2005
Volume 83, Number 12
p. 10

SURFACE CHEMISTRY

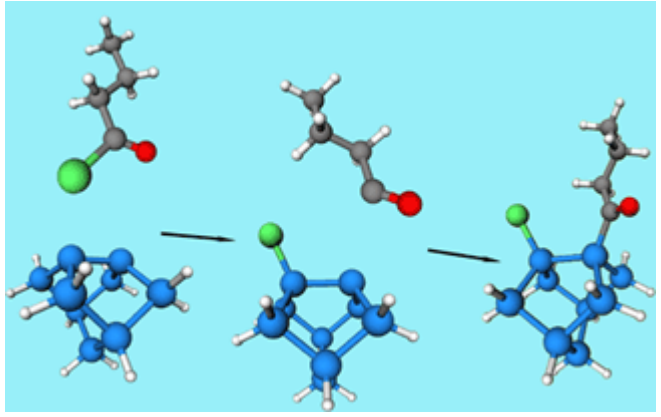
Acid Chlorides On Silicon Surfaces

Method allows silicon to be patterned with functional groups

MICHAEL FREEMANTLE

A novel method for patterning and functionalizing silicon that will enable researchers to selectively deposit amines, alcohols, and proteins on silicon surfaces could find applications in nanotechnology and sensors, according to chemists at Brigham Young University, Provo, Utah (*Langmuir* **2005,** 21, 2093).

"We have shown for the first time that acid chlorides react directly with bare silicon surfaces to create chemisorbed methyl-terminated or acid chloride-terminated monolayers," says assistant professor Matthew R. Linford, who led the team. "Thus, we have a fast, straightforward method for patterning silicon with an important functional group--an activated carboxylic acid." The researchers also have demonstrated that the chemisorbed acid chlorides react with the amino groups of amines and proteins.



MECHANISM The silicon surface, represented by the Si_9H_{12} cluster, abstracts chlorine from butanoyl chloride and then chemisorbs the butanoyl radical. Blue atoms represent silicon; green, chlorine; red, oxygen; white, hydrogen; and gray, carbon.

COURTESY MICHAEL V. LEE AND MATTHEW C. ASPLUND

The technique uses "scribed" silicon--that is, silicon that has been written on or mechanically marked with a tip that moves across the surface and at the same time activates the surface chemically.

The surface-adsorbate reactions are facile, according to the Brigham Young team. The process simply consists of wetting a silicon surface with an acid chloride and scribing. "This procedure takes place in an open laboratory with compounds that have not been degassed or otherwise specially treated," the team notes.

Monoacid chlorides, such as butanoyl chloride, form methyl-terminated monolayers; diacid chlorides--for example, suberoyl chloride [$ClCO(CH_2)_6COCl$]--form acid chloride-terminated monolayers. The group tested the amine reactivity of the acid chloride-terminated monolayers using octylamine, morpholine, piperazine, and the protein bovine serum albumin. They showed that yields for the reactions increase with increasing amine concentration.

Chemical & Engineering News
ISSN 0009-2347