

373h Interaction of Hydrophobic Small Molecules with Switchable Self-Assembled Monolayers

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We report the preparation and characterization of low-density self-assembled monolayers (SAMs) of 16-mercaptohexadecanoic acid (MHA) and 11-mercaptoundecanoic acid (MUA) on gold. We describe the interactions of these low-density monolayers with aqueous lipids and hydrophobic small molecules, as measured by resulting changes in monolayer impedance. These low-density SAMs possess two unique properties which enhance their attractiveness for potential sensor applications. The first is their low surface density, which we achieve by attaching a space-filling chlorotriptyl protective group to MHA or MUA prior to monolayer assembly, and by removal of the protective group following monolayer assembly. This increases the free surface area available for accepting intercalation of compatible molecules (e.g., lipids) from the surrounding solution. The second unique property of low-density SAMs is the ability of its constituent molecules to undergo concerted conformational transitions when a positive electrical potential is applied to the gold surface, which attracts the negatively charged terminal carboxyl groups. The molecules can thus be controllably and reversibly shifted from a “straight” conformation to a “bent” conformation by application or removal of the electrical stimulus. These properties may be exploited for molecular sensing applications. In the “bent” configuration, the monolayer should not accept intercalation of molecules from the surrounding medium, due to an absence of available hydrophobic interaction sites. However, at any desired time after exposure to the medium, the electrical potential can be removed, causing the monolayer to assume the “straight,” low density configuration. The switching properties of these monolayers may ultimately result in rechargeable sensor surfaces.