SUM FREQUENCY GENERATION IMAGING MICROSCOPY (SFGIM): CHEMICAL IMAGING OF PATTERNED SAMs ON GOLD BASED ON THE COMPOSITION, ORIENTATION AND DISTRIBUTION

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This project focuses on the construction and development of the SFG imaging microscope with its application on thiol molecules on gold metal surfaces. The application investigates the orientation of the thiol monolayer on Au with different terminal functional groups, chain lengths and the number of sulfur atoms bound to the metal. The chemical contrast on the images is based on the vibrational spectrum of the molecules oriented at the interface. The microcontact printing process used PDMS stamps with 100 micron x 100 micron checkered features with phenyl-terminated C16 thiol and methyl-terminated C17 thiol/dithiol molecules. The microscope was able to determine a chemical contrast distinction on the surface based on different functionality of the terminal group(methyl vs. phenyl-terminated C16 thiols). On the other hand, the C16 vs. C17 thiols/dithiols demonstrated chemical contrast based on the orientation at the interface (tilt angle). The SFG results showed that more mixing based on the chemical contrast and orientation was observed closer to the border between to different molecule and the dithiols formed a well-ordered monolayer compared to normal alkanethiols. SFG imaging is able to distinguish the location of molecules on the surface based on their inherent vibrational spectrum.