The Wetting Properties of Metallic Substrates Modified with Organic Self-Assembling Monolayers

Vogler, Daniel

This study involved the fabrication and characterization of copper substrates treated with six different self-assembling monolayers following electroless galvanic deposition of silver. The six organic monolayers of heptadecafluoro-1-decanethiol (HDFT), 1-octadecanethiol, carboxymethyl polyethylene-glycol thiol (CM-PEG-SH), dithionitrobenzoic acid (DTNB), thio-1-undecanoic acid, and thiophenol had various polarities, and this study attempted to construct a relationship between this polarity, as quantified by dipole moment, and contact angle. Contact Angle Goniometry characterized the samples' wettability. Subsequently end group polarity of the aforementioned molecules was calculated using computer software and plotted against contact angle. Finally, select samples were imaged using optical and atomic force microscopy (AFM). This study showed a roughly linear, negative relationship between dipole moment and contact angle. Extrapolation of the data suggests that a positive dipole moment correlates with a low water contact angle (indicating that the samples attract water), and a low dipole moment correlates with a higher contact angle, an observation that is reconcilable with experimental results found in the scientific literature. Imaging using AFM provided insights regarding the topography and chemical uniformity of the samples. The surfaces studied in this research have numerous exciting applications; hydrophobic metal surfaces are useful as they improve the efficiency of water-based vessels and devices. PEG-ylated SAMs have been shown to prevent selective adsorption of proteins, making them valuable for biomedical applications, for example implanted biomedical devices.

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