Characterization of organic self-assembled monolayers using bimodal Atomic Force Microscopy

Self-assembled monolayers (SAMs) are one of the most attractive methods of surface modification, as they are highly versatile and their manufacturing approach is easy to scale up[1]. One of their key features is molecular ordering, which, however, is difficult to determine experimentally.
Bimodal AFM[2,3] was used as a novel approach for the characterization of SAMs' ordering, via its correlation to surface elasticity.
Alkanethiol SAMs on Au (111) were used as a model system. Surface elasticity has been reliably determined and found to be ligand-length dependent. A similar investigation has been extended to the characterization of octadecylphosphonic acid SAMs on Al_2O_3. Monolayer formation and ordering as a function of formation time were determined via surface elasticity.
The characterization method was then extended to provide localization of the chemical species present in thiolated binary SAMs. Within the systems tested phase separation down to ~10 nm domains could be observed both in the topography and in the elasticity channel, allowing, for the first time, the chemical identification of the domains.

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