Hydration Lubrication Between Hydrophobic and Hydrophilic Surfaces

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How water rearrange above large stable, smooth, highly hydrophobic surface? We addressed this question by directly measure normal forces and sliding friction under aqueous environment between a negatively-charged hydrophilic mica surface and a fluoropolymer (AF) hydrophobic film, using a surface force balance. The roughness of the AF film was 0.3 nm determined under water by AFM. Normal-force vs. surface-separation profiles indicate that the hydrophobic surface is highly negatively-charge, in line with previous studies and attributed to adsorbed $–OH^-$ ions. Sliding of the compressed surfaces under water or salt solution reveals remarkably low friction (friction coefficient $\mu \approx 0.003 – 0.009$) up to applied pressures of at least 50 atm. Hydration lubrication by trapped hydrated counterions between the surfaces is well explained this efficient lubrication, exist in systems like artificial implants, contact lenses, etc. Moreover, molecules that are present in the biological systems were found to adsorb on the charged hydrophobic surface, contributing to reduced friction.

Reference:

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