Molecular length of Self-Assembled Monolayers Proved by Surface Plasmon Resonance

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Introduction

LSPR (Localized Surface Plasmon Resonance) can be applied to molecular ruler with resolution of angstroms. Some works carried out to measure angstrom molecular length[1], [2]. In this paper, we report the measurement of SAM(self-assembled monolayer) molecular length in some solution through LSPR.

Preparation

SIGN (surface immobilized gold nanospheres) structures as shown in Figure 1 were used. The structure was fabricated by exposure of a 50-nm-thick gold film on a glass substrate to a SAM solution of ethanol. After forming the SAM, it was immersed in an aqueous solution of gold colloid (50nm in diameter). The SAM materials were, $NH_2(CH_2)_{16}SH$(16-Amino-1-hexadecanethiol: AHDT) and $NH_2(CH_2O)_6(CH_2)_{11}SH$(Amino-EG6-undecanethiol: 11PEG). Molecular length are approximately 2.1nm and 3.7nm, respectively. When p-polarized light is incident to the surface of the substrate, it shows strong LSP absorption at the resonance wavelength depending on the gap distance between gold substrate and gold nanospheres. Using this relation, we can evaluate the gap distance from the absorption spectrum.

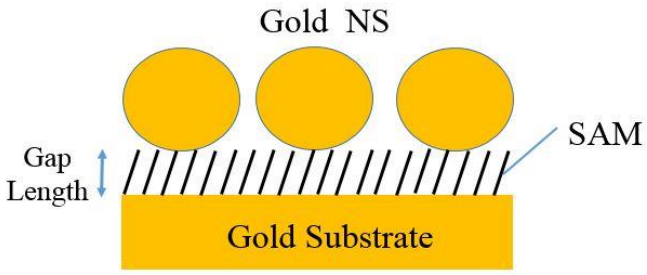

Fig.1 Structure of SIGN

Results and discussion

Figure 2 shows gap distance of (a) 11-PEG and (b) AHDT measured in various ambient. The gap distance of the AHDT SAM in air is similar to that in water, whereas they are different in the 11-PEG SAM. This is because the SAMs are tightly packed in AHDT SAM. This picture is supported by the fact that the gap distance is unchanged when the ambient is the aqueous solution of HCl while it greatly changed in the 11-PEG SAM. In contrast, the PEG groups are loosely packed because of their flexible PEG moiety. In addition, the gap distances were match smaller than SAM molecular length. That is because the SAM molecules are tilted.

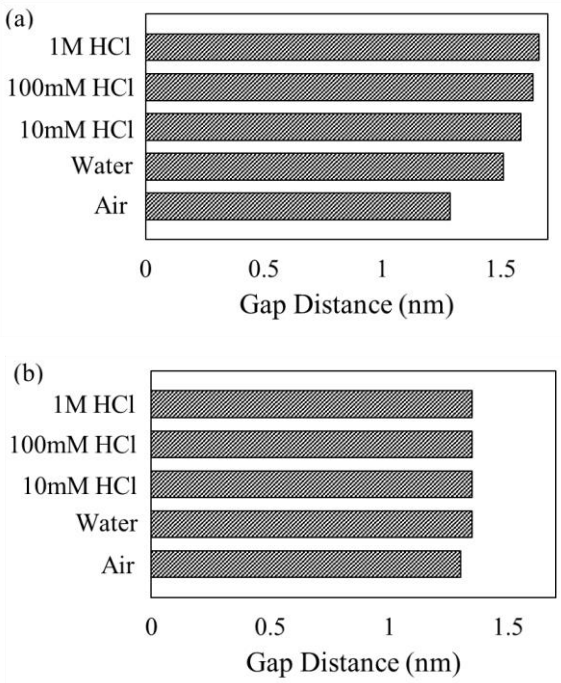

Fig.2 Compares gap distance of (a)11-PEG and (b)AHDT measured in various ambient

Conclusion

We probed the molecular length through measurement of absorption spectroscopy. The gap distance in 11-PEG SAM depends on the ambient medium while that in AHDT SAM is scarcely changed.

References

[1] R.T.Hill et al. ACS Nano, **6**, 9237 (2012)
[2] C.Sönnichsen et al. Nat. Biotechnol., **23**, 741 (2005)