Photochemical surface modification for organosilane multilayers fabrication

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Organosilane self-assembled monolayers (SAMs) have been employed for surface functionalization of various oxide materials. The capability of multilayer fabrication utilizing the SAMs is of particular interest, since multilayers can emerge functions which are not enabled by monolayers alone. In this study, vacuum ultra-violet (VUV) light and VUV-generated active oxygen species have been used to introduce polar functional groups such as carboxyl groups on the upper most surface of an alkylsilane SAM. We have further attempted to stack another organosilane SAM on the VUV-activated SAM by the silane coupling method in which the polar functional groups work as reaction sites.

A SAM was formed on a silicon substrate surface from n-octadecyltrimethoxysilane (ODS) by the vapor phase method [1]. This ODS-SAM coated sample was located in air and irradiated with VUV light at a wavelength of 172 nm. The distance between the light source and the sample surface was regulated to be 30 mm. At this distance, almost of the VUV-light is absorbed with atmospheric oxygen molecules, which are converted to active oxygen species such as ozone and oxygen atoms, and is attenuated down to be about 0.1 % at the sample surface. To build a multilayer, the procedure of oxidizing and deposition was sequentially repeated.

Reference

[1] K. J. Kim et al., Japanese Journal of Applied Physics 47 (2008) 307.