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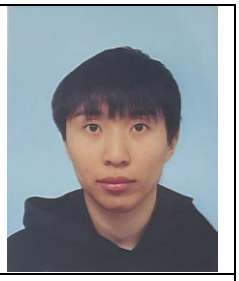

Silica photodeposition in titania nanosheet interlayers and its application to gas barrier materials

We have reported that ultraviolet-light irradiation to titania nanosheet (TNS)-stacked films immersed in tetraethyl orthosilicate solution promoted silica deposition in the interlayers. In this study, the influence of light irradiation duration and precursor solution conditions on the amount and chemical state of the silica nanoparticles formed between the TNS interlayers was evaluated intended to elucidate the mechanism of the photo-induced silica deposition. In addition, the silica-modified TNS films were also applied to a gas barrier coating.

Fig. 1 shows the XPS spectra obtained from unmodified and silica-modified TNS films. The O and Si peaks of the silica-modified TNS shifted to the higher energy side compared to those of the unmodified specimen. The silica modification significantly increased the Si peak intensity. In addition, the XRD peaks attributable to the interlayers shifted to lower angles with increasing light exposure time during silica modification (Fig. 2). It can be concluded that the photoexcitation of TNS promoted hydrolysis of the silicate resulting in silica deposition in the interlayers. In the presentation, the gas barrier capabilities of the specimens will also be discussed.

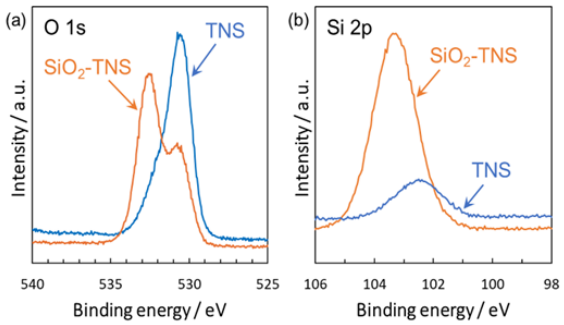

Fig. 1 (a) O 1s and (b) Si 2p XPS spectra of bare TNS thin film and silica-modified TNS thin film (30 min light exposure). An aluminum foil was used as a substrate.

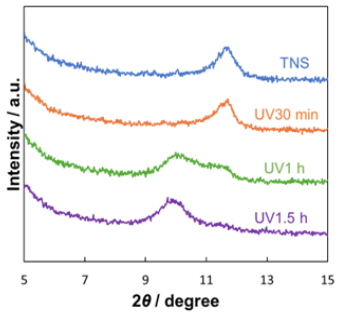

Fig. 2 XRD patterns of bare TNS thin film and silica-modified TNS thin films prepared during light exposure for 0-1.5 h. A glass plate was used as a substrate.