PROGRAM

TT-P004

In Situ X-ray Photoemission Spectroscopy Study of Atomic Layer Deposition of TiO_2 on Silicon Substrate

Seung Youb Lee[1], Cheolho Jeon[1], Yoo Seok Kim[1], Seok Hwan Kim[2], Ki-Seok An[2], Chong-Yun Park[1]*

[1]BK21 Physics Research Division and Department of Energy Science, Sungkyunkwan University, Suwon 440-746, Republic of Korea, [2]Device Materials Research Center, Korea Research Institute of Chemical Technology, Yuseong P.O. Box 107, Daejon 305-600, Republic of Korea

Titanium dioxide (TiO2) has a number of applications in optics and electronics due to its superior properties, such as physical and chemical stability, high refractive index, good transmission in vis and NIR regions, and high dielectric constant. Atomic layer deposition (ALD), also called atomic layer epitaxy, can be regarded as a special modification of the chemical vapor deposition method. ALD is a pulsed method in which the reactant vapors are alternately supplied onto the substrate. During each pulse, the precursors chemisorb or react with the surface groups. When the process conditions are suitably chosen, the film growth proceeds by alternate saturative surface reactions and is thus self-limiting. This makes it possible to cover even complex shaped objects with a uniform film. It is also possible to control the film thickness accurately simply by controlling the number of pulsing cycles repeated.

We have investigated the ALD of TiO2 at 100°C using precursors titanium tetra-isopropoxide (TTIP) and H2O on -O, -OH terminated Si surface by in situ X-ray photoemission spectroscopy. ALD reactions with TTIP were performed on the H2O-dosed Si substrate at 100°C, where one cycle was completed. The number of ALD cycles was increased by repeated deposition of H2O and TTIP at 100°C. After precursor exposure, the samples were transferred under vacuum from the reaction chamber to the UHV chamber at room temperature for in situ XPS analysis. The XPS instrument included a hemispherical analyzer (ALPHA 110) and a monochromatic X-ray source generated by exciting Al Kα radiation (hν=1486.6 eV).

Keywords: Atomic layer deposition, Titanium dioxide, X-ray photoemission spectroscopy