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Abstract
In this study, nitrogen-doped titanium oxide ($TiO_{2-x}N_x$) films were grown on high doped n-type Si (100) and ITO glass substrates by using precursors of $TiCl_4$ and ammonia water in an atomic layer deposition (ALD) system. The film structures and photocatalytic properties were characterized by XRD, SEM, XPS, UV-visible spectroscopy, contact angle, and photocurrent response. The growth rate is about 0.03 nm per cycle at deposition temperature of 200oC, 0.05 nm per cycle at deposition temperature of 300oC, and 0.07 nm per cycle at deposition temperatures of 400~600oC. XRD results show that the $TiO_{2-x}N_x$ are amorphous, crystalline anatase, and crystalline rutile at deposition temperatures of 200oC, 300~500oC, and 600oC, respectively. The temperature for rutile phase formation is lowered by increasing the reaction gas ratio of NH_3 to H_2O. The SEM images demonstrate that the film has a large grain size of 75 nm at deposition temperature of 300oC, but a small grain size of 37.5 nm at deposition temperature of 400oC. The grain size increases with increasing deposition temperature at temperature between 400 and 600oC. There is the smallest water contact angle at deposition temperatures of 500oC. The nitrogen incorporation was confirmed by XPS. The light absorption edge of $TiO_{2-x}N_x$ films is shifted to 513 nm by the nitrogen incorporation. The photocurrent response of $TiO_{2-x}N_x$ films is further shifted to 550 nm by increasing NH_3/H_2O ratio, and 564 nm by increasing the $TiO_{2-x}N_x$ film thickness.
Advisory Committee Cheng Hsyi En - advisor

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