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The Structural and Physical Properties of Ti films by RF magnetron sputtering

송용화, 정충경, 부진효
성균관대학교 화학과

Metallic Ti thin films were deposited on both pure Si(100) and modified Si(100) with oxygen or nitrogen by using RF magnetron sputtering method. The dependence of the structural and mechanical properties was mainly studied in this work with varied distance between target and substrate (D_{ts}) as well as with the increase of film thickness from 100 to 600 nm. The hardness (H) and Young's modulus (E) values were found in the range of 9 - 14 GPa and 177 - 205 GPa. The general tendency revealed that with increasing D_{ts} from 10 mm to 50 mm and with decreasing film thickness, the H and E were decreased, respectively. In order to confirm this general tendency as well as to compare structural properties of as-grown Ti thin films on different Si(100) substrates, moreover, we applied manykind of surface analytic methods after making the thin films of Ti/Si(100), Ti/O/Si(100), and Ti/N/Si(100). X-ray diffraction (XRD) data showed a distinct change of major film growth direction. In the case of Ti film growth on pure Si(100) surface, the film was strongly grown in the [100] direction while Ti film with highly growth in the [002] direction has been observed on the nitrogen terminated N/Si(100) surface. The details of film growth direction, nanostructural characteristics as well as surface composition analysis were also carried out by SEM/EDX, atomic force microscopy (AFM) and FT-IR spectroscopy.