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Substrate temperature dependence of crystalline Y_2O_3 films grown by Ionized Cluster Beam Deposition

M.H.Cho, S.W.Whangbo, J.G.Seo, S.C.Choi[1], S.J.Cho[2] and C.N.Whang

Department of Physics & Atomic-scale Surface Science Research Center,
Yonsei University, Seoul 120-749, Korea.
[1]Korea Institute of Science and Technology, Ceramics Division, Seoul 130-650, Korea.
[2]Department of Physics, Kyungseong University, Pusan 608-736, Korea.

ABSTRACTS

The Y_2O_3 films on Si(111) was grown by ionized cluster beam deposition (ICBD) in ultrahigh-vacuum (UHV). The acceleration voltage and oxygen partial pressure were fixed at 5 kV and $2x10^{-5}$ Torr respectively. The substrate temperature was varied from 100℃ to 600℃ in order to find the dependence of crystallinity of Y_2O_3 film on the substrate temperature. The crystallinity of the films with the substrate temperature was studied using x-ray diffraction (XRD) and Rutherford backscattering spectroscopy (RBS). Surface crystallinity and surface morphology of the films were also investigated using the reflection high-energy electron diffraction (RHEED) and atomic force microscope (AFM), respectively. The films grown at the substrate temperature below 500℃ showed the poly-crystalline structure of oxygen deficiency. On the contrary, the single-crystalline structure was obtained at the substrate temperature over 500℃ and the stochiometry was gradually matched as increasing the substrate temperature. The surface morphology showed the increase of the surface roughness as the substrate temperature was increased up to 500℃. The crystallinity of the film was not good, and the minimum channeling yield χ_{min} was measured at 0.91. The stochiometric and high crystallinine film (surface χ_{min}=0.25) was obtained as the substrate temperature increased up to 600℃, which indicate the temperature was sufficient to migrate the deposited atom.

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