Substrate temperature and sputtering power effect on the growth of MgO thin films

Jitendra Pal SINGH [1] and Keun Hwa Chae [1]
[1]KIST,SEOUL, Korea, Republic of

Radio frequencysputtering is one of suitable method to grow oxide thin films. Duringsputtering, deposition parameters play important role in determiningcharacteristics of thin films. Thus, present work is motivated to investigatethe effect of substrate temperature and sputtering power on the growth of MgOthin films.

MgO thin films weregrown under Ar environment and in-situ annealed at 700°C for 3 h.The base pressure was kept at 5+10^{-7} Torr for deposition. The growth was investigated at two sputteringpower of 40 and 60W. The substrate temperature was kept at room temperature (RT),350 and 700°C. Growthof thus obtained thin films were investigated using X-ray reflectivity (XRR) measurements.These measurements were performed at 1D XAS-KIST beamline of Pohang AcceleratorLaboratory, Pohang, South Korea. Obtained XRR curves were simulated usingParratt software. The model used forsimulation contains an interface region alongwith MgO layer. This layer is alsoobserved from HRTEM. Thickness estimatedfrom XRR curves are 22.4‡0.1, 17.9‡0.2, 11.0‡0.1 nm for substrate temperatureof 27, 350 and 700°C, respectively with sputtering power of 40W.When sputtering power is increased to 60W, thickness of these films are28.6‡0.2 and 15.6‡0.1 nm for substrate temperature of 27 and 350° C,respectively. Thickness variation with substrate temperature determined fromthese curves is analogues to that determined from RBS. However, values arecomparable to that determined from HRTEM. Surface roughness of these films are influenced by both sputtering powerand substrate temperature. The growth of these films are discussed on the basisof existing theories.

This work wassupported by Korea Institute of Science and Technology, Seoul Korea (KIST Project No.: 2V06030).