

大気圧ミスト CVD による AlO_x 薄膜作製時における水の役割

The role of water in the synthesis of AlO_x thin films by a mist chemical vapor deposition

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The role of water as an additive during the synthesis of aluminum oxide (AlO_x) thin films by mist chemical vapor deposition (mist CVD) was investigated. This study was based on deposition using aluminum acetylacetonate ($\text{Al}(\text{acac})_3$) and methanol (MeOH), while also exposing some films to water or methanol mists after fabrication. Analysis by AFM and FTIR spectroscopy established that the AlO_x films fabricated from $\text{Al}(\text{acac})_3$ using methanol as the sole exhibited a distorted $\text{Al}(\text{OH})$ network, including a high concentration of OH groups. The addition of water to the $\text{Al}(\text{acac})_3/\text{MeOH}$ precursor decreased the film deposition rate and also lead to marked reductions in both the surface roughness and -OH concentration. Exposing the $\text{Al}(\text{OH})$ films to water mist after synthesis resulted in etching together with the removal of -OH groups and decreases in surface roughness. Exposure to water induced no significant changes in the surface chemistry or morphology of AlO_x thin films deposited at a $\text{MeOH}:\text{water}$ volume ratio of 7:3. However, FTIR spectra demonstrated that exposing these AlO_x films to a MeOH mist promoted the formation of $\text{Al}(\text{OH})$ bonds. Figure 1 shows the schematic of the growth surface for the $\text{MeOH}:\text{water}$ ratios of 10:0 and 7:3. The results of this work indicate that the incorporation of -OH groups into the AlO_x network generates both network distortion and inhomogeneity. It is also evident that water present during film growth removes -OH groups during the growth, resulting in the formation of a dense, uniform AlO_x network. The effect of the substrate bias on the AlO_x film properties will be also presented.

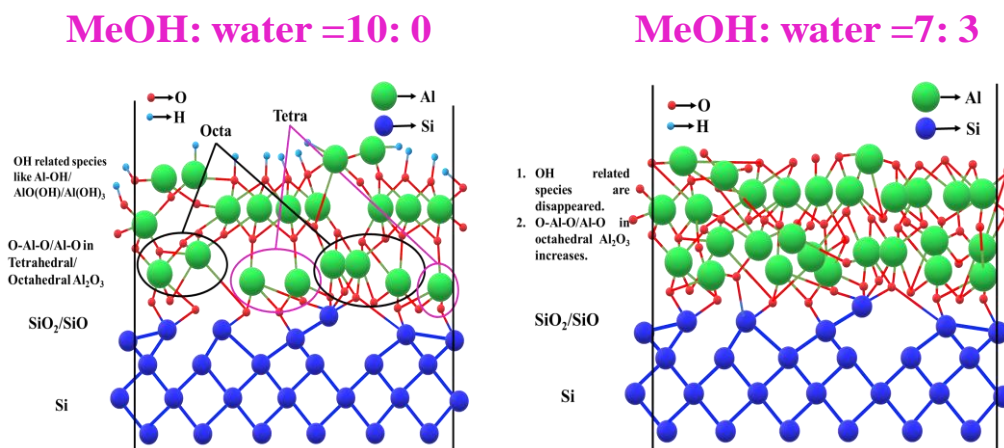


Fig. 1 Schematic of the growth surface of AlO_x by mist CVD with $\text{MeOH}:\text{water}$ of 10:0 and 7:3.