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**X-ray photoelectron spectroscopy studies on AlN thin films grown by ion beam sputtering
in reactive assistance of N^+/N_2^+ ions: Substrate temperature induced compositional
variations**

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Abstract: We report here XPS study of AlN thin films grown on Si(100) substrates at different temperatures by ion beam sputter deposition (IBSD) under reactive assistance of N^+/N_2^+ ions. The compositional variations on their surface as well as at a depth of 50 nm beneath the surface are presented and discussed. The temperature of the substrate was varied as room temperature (RT), 100°C and 500°C. The binding energy of Al-2p, N-1s and O-1s core level electrons indicated formation of 2H polytypoid of AlN. The increase in concentration of AlN with substrate temperature during deposition is elucidated through a detailed analysis of calculated elemental atomic concentrations (at. %) of all possible phases present at the film surface as well as beneath the surface. Our results show predominant formation of AlN as high as 74.0 at. % on the surface and 89.0 at. % at a depth of 50 nm beneath the surface is achieved by using the substrate temperature as a deposition process variable. This high phase fraction of AlN in thin film surface is significant when compared to other growth techniques. In addition, simultaneous formation of stoichiometrically different phases could be established from measurement of element concentrations.

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