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Growth dynamics of reactive-sputtering-deposited AlN films

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Abstract-

We have studied the surface kinetic roughening of AlN films grown on Si(100) substrates by dc reactive sputtering within the framework of the dynamic scaling theory. Films deposited under the same experimental conditions for different growth times were analyzed by atomic force microscopy and x-ray diffraction. The AlN films display a (002) preferred orientation. We have found two growth regimes with a crossover time of 36 min. In the first regime, the growth dynamics is unstable and the films present two types of textured domains, well textured and randomly oriented, respectively. In contrast, in the second regime the films are homogeneous and well textured, leading to a relative stabilization of the surface roughness characterized by a growth exponent beta=0.37 +/- 0.03. In this regime a superrough scaling behavior is found with the following exponents: (i) Global exponents: roughness exponent alpha=1.2 +/- 0.2 and beta=0.37 +/- 0.03 and coarsening exponent 1/z=0.32 +/- 0.05; (ii) local exponents: alpha(loc)=1, beta(loc)=0.32 +/- 0.01. The differences between the growth modes are found to be related to the different main growth mechanisms dominating their growth dynamics: sticking anisotropy and shadowing, respectively. (c) 2005 American Institute of Physics.

Index Terms- chemical-vapor-deposition, aluminum nitride films, acoustic-wave devices, x-ray reflectivity, surface-roughness, buffer layers, instability, microscop

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