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Structural and optical properties of AlN grown on nanopillar/patterned SiO_2 by Hydride Vapor Phase Epitaxy

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Abstract

We demonstrate the growth of high-quality AlN layers on an AlN nanopillar structure with a patterned SiO_2 layer employing horizontal hydride vapor phase epitaxy (HVPE). The use of the AlN nanopillar structure with the patterned SiO_2 resulted in improving the crystalline, and overall material properties of the AlN layer. The full width half maximum (FWHM) of peaks corresponding to (002) and (102) reflections of the AlN layer with the nanopillar structure were significantly decreased from 386 and 576 arcsec to 265 and 318 arcsec, respectively, as compared with that of the as-grown AlN layer. The laterally overgrown AlN regions consisted of a continuous well-coalesced layer exhibiting a lower dislocation density than that of the templates used owing to the dislocation blocking and dislocation bending effects. Complementary characterization by transmittance, photoluminescence and Raman spectroscope, indicates further the overall good material properties of the AlN layer grown on the nanopillar structure.

Keywords: Aluminum nitride; Nanostructures; Horizontal Hydride Vapor Phase Epitaxy; Refractive index

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