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Abstract
[002]-oriented aluminum nitride (AlN) is a promising piezoelectric material for surface acoustic wave (SAW) devices due to its high wave propagation speed and fairly large piezoelectric coupling factor. In this research, a special thin film growth technique named reactive medium frequency magnetron sputtering was employed to prepare AlN films. The process parameters such as spacing between target and substrate, pressure of chamber, concentration of nitrogen, and sputtering power on the film growth were investigated. The results show that lower process pressure, shorter spacing between target and substrate, lower concentration of nitrogen, and higher sputtering power can improve the formation of [002]-oriented AlN thin films. SEM analysis revealed that the [002] textured AlN film has smooth surface and uniform grain size. The best condition for [002] textured AlN film in this study is spacing between target and substrate 10cm, process pressure 1mTorr, N2 concentration 30%, and sputtering power 2kW.The mechanisms of texture formation in AlN films were discussed. The surface acoustic wave device was then formed on the [002] oriented AlN films to evaluate its performance.
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