Impedance spectroscopy analysis of Al/100-plane AlN/p-Si MIS prepared by HiPIMS method for tailoring dielectric properties

ABSTRACT

The effects of variation of sputtering pressure of AlN HiPIMS deposition on Si substrate to the structure and electrical properties were investigated through XRD, AFM and impedance spectroscopy method. The strong preferred 100-plane AlN was observed for all samples from XRD pattern. The AlN thin film thickness was observed decrease with the increase of sputtering pressure. AFM analysis shows the lowest surface roughness at 0.84 nm for 5 mTorr sputtering pressure. Impedance spectroscopy analysis of Al/100-plane AlN/Si MIS structure shows the electrical conductivity of AlN was directly proportional to the sputtering pressure and stable with temperature ranging from room temperature (299 K) to 353 K. Good dielectric stability was achieved at 3 mTorr sputtering pressure for all variation temperature and the dielectric constant calculated at average 3.5.