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Plasma etching of aluminum nitride thin films prepared by magnetron sputtering method

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Several properties of the AlN films as e.g., isomorphous crystallographic structure, high resistivity ($\sim 10^{13} \Omega \text{ cm}$), high thermal stability (up to 2200 °C) and high thermal conductivity ($\sim 320 \text{ W/mK}$), make it excellent material for application in structure of HEMT, FET transistors, playing role of dielectric.

The AlN films were deposited using magnetron ($r = 100 \text{ mm}$) and pulse power supplier ($f = 100 \text{ kHz}$, with modulation of $f = 2 \text{ kHz}$; current 3A). Deposition processes were carried out at pulsed pressure from 10^{-3} Pa to 10^{-1} Pa and using Ar/N₂ gas mixture. The films were deposited on n-type silicon wafers located in parallel to aluminum target, with substrate-target distance at 10 cm.

However, reaching a level of considerable maturity by technology of any electronic material requires not only adequate methods of its synthesis but also capabilities of material processing, among others availability of means of its selective etching.

Investigated in this work thin AlN films were selective etched in RF plasma environment in the 13.56 MHz OXFORD PLASMALAB 80+ set-up. The influence of etching process parameters, like etching gas composition, its flow rate and RF power on etching rate and the state of exposed Si surface was subsequently studied and is discussed.

Keywords

aluminum nitride

plasma etching

magnetron sputtering