

High-Quality Etching of GaN Materials with Extremely Slow Rate and Low Damage

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High-quality gallium nitride etching is highly desirable in electronic device fabrications. For the GaN base devices, the electronic properties largely depended on the etching induced surface damages. To overcome this, a controllable GaN etching method was developed using inductively coupled plasma reactive ion etching (ICP-RIE) by controlling radio frequency (RF) power, and DC bias. The etching rate, DC bias, and root-mean-square surface roughness were measured as a function of bias power under different RF, 40 and 13.56 MHz. The effects of ICP power and chlorine to argon percentage were systematically studied. An extremely slow etching rate and low-damage surface were achieved by reducing DC bias power to 25 W under RF 40 MHz. Ni|Au Schottky diodes were fabricated and characterized. The diode fabricated on the 40-MHz RF etching GaN surface has a much lower ideal factor and higher barrier height than non-etched GaN and RF 13.56 MHz etching GaN.

Keywords: etching, radio frequency bias, surface roughness, plasma-induced damage, Schottky electrodes.

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