Improvement of hydrogen detection in a-plane GaN Schottky diode by surface roughening

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A-plane GaN Schottky diode hydrogen sensors incorporating intentionally roughened surface in the active area by wet etching have been demonstrated. Wet etching was used to improve hydrogen responsivity by roughening the gate surface to increase hydrogen sensing area. A-plane GaN was wet etched in KOH etchant solution at the low temperature of 80 degree Celsius under UV light irradiation. The selectively etched surface area remained after depositing very thin catalytically active platinum layer. The device showed distinct rectifying current-voltage characteristics. A-plane GaN Schottky diode with surface roughened active area showed improved current response to hydrogen compared to unetched reference sensor. Sensitivities to 4% hydrogen were 3.2 x 107 % and 1.3 x 106 % respectively for etched and unetched a-plane GaN sensors. Also, Schottky barrier height reduction of surface modified a-plane sensor was as much as 0.47eV. Using simple low temperature surface roughening, sensitivity of a-plane GaN hydrogen sensor was dramatically improved more than 1000%.