

## ENHANCING PERFORMANCE OF POROUS Si- DOPED GaN BASED MSM PHOTODETECTOR USING 50 Hz ACPEC

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**ABSTRACT-** In this work, we report the formation of porous Si-doped GaN films under a novel alternating current (sine-wave a.c. (50 Hz)) photo-assisted electrochemical etching (ACPEC) conditions. The formation of porous Si-doped GaN by the novel ACPEC is performed in the same electrolyte concentration (4% KOH) used in common dc constant current electrochemical etching process. Ultra-violet (UV) illumination is used to assist in the generation of electron-hole pairs, where etching proceeds through the oxidation and consequently, dissolution of the semiconductor surface. The ac formed porous Si-doped GaN with excellent structural and optical properties. According to the FESEM micrographs, the GaN thin films exhibit a homogeneous nanoporous structures with spatial nano-flakes arrangement. The porous layer exhibited a substantial photoluminescence (PL) intensity enhancement with red-shifted band-edge PL peaks associated with the relaxation of compressive stress. The shift of E<sub>2</sub>(high) to the lower frequency in Raman spectra of the porous GaN films further confirms such a stress relaxation. Electrical characterizations of the MSM photodiodes were carried out by using current-voltage (I-V) measurements indicated that the devices were highly sensitive to ambient light.

**Keywords:** porous Si-Doped GaN, ACPEC, FESEM, nano-flakes structure, metal-semiconductor-metal-photodetector.