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INFLUENCE OF ETCHING TIME ON THE POROUS P-TYPE GALLIUM NITRIDE USING ALTERNATING CURRENT PHOTO-ASSISTED ELECTROCHEMICAL ETCHING TECHNIQUE

Siti Nurfarhana Sohimee^{1,*}, Zainuriah Hassan^{1,*}, Naser M. Ahmed², Rosfariza Radzali³,
Way Foong Lim¹

¹*Institute of Nano Optoelectronics Research and Technology (INOR),
Universiti Sains Malaysia, 11800 Penang, MALAYSIA.*

²*School of Physics, Universiti Sains Malaysia, 11800 Penang, MALAYSIA.*

³*Faculty of Electrical Engineering, Universiti Teknologi MARA, 13500 Permatang Pauh,
Penang, MALAYSIA.*

**Corresponding Author: farhanasohimee@gmail.com, zai@usm.my*

ABSTRACT- The theoretical and experimental study of porous p-type gallium nitride (GaN) is discussed in this work. Porous p-type GaN was adequately fabricated using alternating current photo-assisted electrochemical etching technique with various etching times (10, 20, 30, and 60 minutes) in mixed hydrofluoric acid and ethanol electrolyte solutions (1:4 volume ratios) under ultraviolet illuminations. The evolution of morphology of non-porous and porous p-type GaN as a function of etching time was imaged using field emission scanning electron microscopy measurement. Surface analysis revealed a sporadic pore size with circular shape was found in porous p-type GaN while smooth and no pores was observed in non-porous p-type GaN sample. Etching for a brief time frame resulted in small pores, and etching for longer times resulted in enormous pores. However, prolonged etching times of 60 minutes would prompt breakdown of porous layer. The average pore diameter and porosity of the investigated samples were estimated from the ImageJ software. Subsequent effort by investigating the structural characteristics of non-porous and porous samples by variety of methods, including high resolution x-ray diffraction and atomic force microscopy. A significant increase in the surface roughness was observed with an increase in the etching time. The discoveries found that the influence of etching duration has indicated noteworthy impacts towards morphological and structural properties of the porous p-type GaN, as supportively revealed through pore size, porosity, and surface roughness.

Keywords: Porous, p-type gallium nitride, Alternating current, Etching, Ultraviolet.