HAL
open science

Fabrication and characterization of Si3N4-MIS structures on p-type diamond

Lya Fontaine, Karine Isoird, Josiane Tasselli, Emmanuel Scheid, Patrick Austin, Alain Cazarre, Riadh Issaoui

To cite this version:

Lya Fontaine, Karine Isoird, Josiane Tasselli, Emmanuel Scheid, Patrick Austin, et al.. Fabrication and characterization of Si3N4-MIS structures on p-type diamond. 31st International Conference on Diamond and Carbon Materials, Sep 2021, On line, Spain. hal-03445543

HAL Id: hal-03445543

https://laas.hal.science/hal-03445543

Submitted on 24 Nov 2021

HAL is a multi-disciplinary open access archive for the deposit and dissemination of scientific research documents, whether they are published or not. The documents may come from teaching and research institutions in France or abroad, or from public or private research centers.

L'archive ouverte pluridisciplinaire **HAL**, est destinée au dépôt et à la diffusion de documents scientifiques de niveau recherche, publiés ou non, émanant des établissements d'enseignement et de recherche français ou étrangers, des laboratoires publics ou privés.

Fabrication and characterization of Si_3N_4-MIS structures on p-type diamond

Lya FONTAINE [1], Karine ISOIRD [1], Josiane TASSELLI [1], Emmanuel SCHEID[1], Patrick AUSTIN [1], Alain CAZARRE [1], Riadh ISSAOUI [2]

[1] LAAS-CNRS Université de Toulouse, CNRS, UPS, Toulouse, France

[2] LSPM Université Paris 13, Villetaneuse, France

Key words: MIS structure, MOS power devices, Si_3N_4

With its wide bandgap and interesting electronic properties, diamond is a promising material for high power applications. However, several technological obstacles have to be overcome to develop MOS diamond devices. In this context, we study the fabrication of MIS structures based on the deposition of a Si_3N_4-dielectric layer. The C(V) measurements are presented and the interface between diamond and Si_3N_4 is analyzed.

MIS structures are fabricated on a P^-/P^+ stack on (100) diamond at LSPM laboratory with doping estimated to be [B] = $1x10^{17}$ at.cm^{-3}/[B] = $1x10^{20}$ at.cm^{-3} for 4µm/10µm thicknesses respectively.

The diamond layers surface is chemically cleaned and treated using Ozone UV to ensure the elimination of contaminants and C-H bonds in order to limit the number of traps at the interface between diamond and the dielectric layer.

A 30nm-Si_3N_4 layer is deposited by LPCVD at 770°C. Ohmic contacts using Ti/Pt/Au are fabricated on the P+ layer and Al contacts (of a diameter of 300µm, 200µm and 100µm) were deposited on the dielectric layer.

The module and argument variations of the impedance are then measured. These characteristics show the capacitive behavior of the structures over a wide frequency range, from 1 kHz to 100 kHz. The influence of the diamond p- layer resistivity is therefore negligible. A two-element model (capacitance and resistance in parallel representing leaks) is therefore used hereafter.

C(V) measurements show the different modes of accumulation, depletion and deep depletion. Comparison between measurement and to the theoretical curve calculated from the model of the ideal MIS device highlights the presence of a significant number of traps.

The development of these functional MIS structures opens the way to the manufacturing of diamond power MOS devices, even if a limitation of the traps is still necessary.