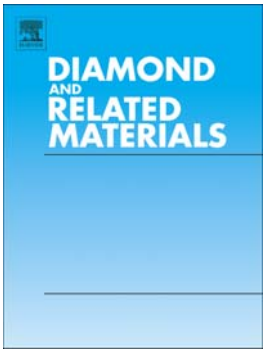

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Diamond based field-effect transistors with SiN_x and ZrO_2 double dielectric layers

W. Wang[1], K. Fu[2], C. Hu[1], F. N. Li[1], Z. C. Liu[1], S. Y. Li[1], F. Lin[1], J. Fu[1], Jingjing Wang[3,]* and H. X. Wang*

[1]Key Laboratory for Physical Electronics and Devices of the Ministry of Education, the School of Electronic and Information Engineering, Xi'an Jiaotong University, Xi'an 710049, P. R. China

[2]Key Lab of Nanodevices and Applications, Suzhou Institute of Nano-Tech and Nano-Bionics, Chinese Academy of Sciences (CAS), Suzhou 215123, P. R. China.

[3]Nation Key Laboratory of ASIC, Hebei Semiconductor Research Institute, Shijiazhuang 050051, China

*corresponding author: hxwangcn@mail.xjtu.edu.cn, cooper_shenyang@163.com

Abstract: A diamond-based field-effect transistor (FET) with SiN_x and ZrO_2 double dielectric layer has been demonstrated. The SiN_x and ZrO_2 gate dielectric are deposited by plasma-enhanced chemical vapor deposition (PECVD) and radio frequency (RF) sputter methods, respectively. SiN_x layer is found to have the ability to preserve the conduction channel at the surface of hydrogen-terminated diamond film. The leakage current density (J) of SiN_x/ZrO_2 diamond metal-insulator-semiconductor FET (MISFET) keeps lower than 3.88×10^{-5} $A\cdot cm^{-2}$ when the gate bias was changed from 2V to -8V. The double dielectric layer FET operates in a p-type depletion mode, whose maximum drain-source current, threshold voltage, maximum transconductance, effective mobility and sheet hole density are determined to be -28.5 $mA\cdot mm^{-1}$, 2.2V, 4.53 $mS\cdot mm^{-1}$, 38.9 $cm^2\cdot V^{-1}\cdot s^{-1}$, and 2.14×10^{13} cm^{-2}, respectively.

Key words: field-effect transistor; double dielectric layer; SiN_x/ZrO_2; conduction channel

1. Introduction

Recently, diamond is considered to be an ideal material for the next generation of power devices and high frequency field effect transistor (FET) due to its wide band