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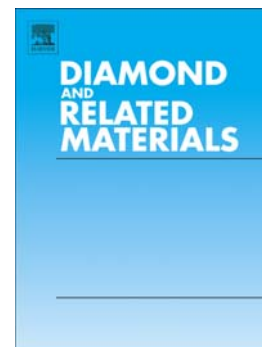
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Diamond based field-effect transistors with SiN_x and ZrO₂ double dielectric layers

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Abstract: A diamond-based field-effect transistor (FET) with SiN_x and ZrO₂ double dielectric layer has been demonstrated. The SiN_x and ZrO₂ 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/ZrO₂ diamond metal-insulator-semiconductor FET (MISFET) keeps lower than $3.88 \times 10^{-5} \text{ A} \cdot \text{cm}^{-2}$ 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 $-28.5 \text{ mA} \cdot \text{mm}^{-1}$, 2.2V, $4.53 \text{ mS} \cdot \text{mm}^{-1}$, $38.9 \text{ cm}^2 \cdot \text{V}^{-1} \cdot \text{s}^{-1}$, and $2.14 \times 10^{13} \text{ cm}^{-2}$, respectively.

Key words: field-effect transistor; double dielectric layer; SiN_x/ZrO₂; 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

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