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STUDY OF REDUCED SELF-HEATING EFFECT IN β Ga_2O_3 ON A DIFFERENT SUBSTRATES UTILIZING SILVACO TCAD

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AUTHOR'S DECLARATION

I declare that the work in this thesis was carried out in accordance with the regulations of Universiti Teknologi MARA. It is original and is the results of my own work, unless otherwise indicated or acknowledged as referenced work.

I, hereby, acknowledge that I have been supplied with the Academic Rules and Regulations, Universiti Teknologi MARA, regulating the conduct of my study and research.

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ABSTRACT

The architecture of high-power electronics proficient of operating at high temperatures without the need for comprehensive device heat reduction is desirable in wide sectors mainly industrial β-$Ga_2O_3$is a preferable wide band gap semiconductor for having good electrical properties suitable for power applications. However β-Ga_2O_3 suffers low thermal conductivity (~0.2Wcm−1 K−1). The problem resulting in poor heat dissipation, it called self-heating effect which reduce carrier mobility and drain current degradation. Thus, the project was conducted using simulation software from SILVACO TCAD to investigate β-Ga_2O_3 fabricated on different substrates which is 4H-SiC, Silicon and β-Ga_2O_3. The structures created is to mitigate the problem to helps improve device performances. This research aim is to study the effect of reduced self-heating effect in β-Ga_2O_3 MOSFET on different substrates utilizing SILVACO TCAD. I-V characteristic was analysed to evaluate and determine the performance of the device on various substrates helps to reduce the self-heating effect on the device. The results of the study shows that the drain current increases and slowly degrades specifically for Silicon substrates. The simulation found that 4H-SiC as hetero-epitaxial substrates helps to reduce the problem faced on β-Ga_2O_3 device by increasing origin drain current by 32.67% from 50.81mA to 67.41mA at Vg=8V. Hence, 4H-SiC is suitable substrate to increase the performance and reduce the self-heating effect of β-Ga_2O_3 substrates.

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