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PERFORMANCE ANALYSIS OF A SILVER AND GRAPHITE COATED GALLIUM ARSENIDE (GaAs) MOSFET

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Abstract

The GaAs MOSFET was designed with an aluminium gate, graphite - coated electrodes, and silver nanoparticles embedded in the N-type GaAs channel. The device had a channel length of 1 nm, a width of 10 nm, and an oxide thickness of 0.5 nm. All simulations were performed at room temperature. MATLAB was used to model the device, combining analytical equations with spatially resolved numerical methods to accurately capture its electrical behaviour. Key performance parameters, including threshold voltage, drain current, and leakage current, were extracted. Analysis drain current of the MOSFET considered the influence of oxide thickness, temperature, channel length, and width on overall device performance. The threshold voltage (V_{Th}) of 0.8719 V was obtained and it confirms enhancement mode operation. The simulated GaAs-based MOSFET exhibited a drain current of 6.48 mA cm^{-1} and a transconductance of 275.76 mS cm^{-1} at a gate-to-source voltage (V_{GS}) 1.2 V, while the device operating in the saturation region, indicating enhanced carrier mobility and strong gate control. The overall average mobility value of 0.5934 $m^2 V^{-1} s^{-1}$ indicates high carrier transport efficiency.

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