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| **Abstract:** |  |
| This research paper investigates the potential of silicon nitride gate materials for enhancing the performance of silicon- based Metal-Oxide -Semiconductor Field-Effect Transistors (MOSFETs). Through simulations conducted using COMSOL Multiphysics, we analyzed the impact of using silicon nitride gate materials on MOSFET performance. Our results demonstrate that silicon nitride gate materials offer improved device characteristics, including reduced gate leakage currents, enhanced carrier mobility, and reduced threshold voltage variability. These findings underscore the potential of silicon nitride as a key material for advancing the performance of MOSFETs, paving the way for more efficient and reliable semiconductor devices in the future. | |