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(71)Name of Applicant :

1)INDIAN INSTITUTE OF TECHNOLOGY (INDIAN SCHOOL OF MINES), DHANBAD

Address of Applicant :Dhanbad - 826004, Jharkhand, India Dhanbad -----

Name of Applicant : NA

Address of Applicant : NA

(72)Name of Inventor :

1)Chumki Das

Address of Applicant :Department of Electronics Engineering, Indian Institute of Technology (Indian School of Mines), Dhanbad, Dhanbad - 826004, Jharkhand, India Dhanbad -----

2)Kaushik Mazumdar

Address of Applicant :Department of Electronics Engineering, Indian Institute of Technology (Indian School of Mines), Dhanbad, Dhanbad - 826004, Jharkhand, India Dhanbad -----

(57) Abstract :

The present invention relates to a high performance In_{0.22}Al_{0.2}Ga_{0.58}As/In_{0.63}Ga_{0.37}As High-Electron-Mobility transistor (HEMT) (100) with TiO₂ passivation for RF application. HEMT (100) comprises of an epitaxial layer (E) comprising a silicon substrate (10) as the bottom of the HEMT (100), a Al₂O₃ (BOX) layer (20), a channel layer (30), an insulator or barrier layer (40), a GaAs etch stop layer (50) consecutively one above the other. A cap layer (C) above the epitaxial layer (E) comprises of a heavily doped In_{0.22}Al_{0.2}Ga_{0.58}As upper subcap layer (C1), a heavily doped InP middle subcap layer (C2), a heavily doped In_{0.52}Al_{0.48}As lower subcap layer (C3). A gate oxide layer (G) TiO₂ is generated above the cap layer (C). Utilizing InAlGaAs materials as a barrier layer and cap layer to enhances electron mobility, thereby improving the overall performance. The incorporation of high-k dielectric materials like TiO₂ improves the gate capacitance, allowing for better control over the channel and reducing leakage currents. The unique cap layer structure, incorporating multiple materials with optimized doping levels, significantly reduces parasitic resistance, further enhancing HEMT performance. [Fig. 1]

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