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Dipoles in III-V MOSFETs: Scattering and Threshold shifts RAJ JANA, DEBDEEP JENA, Univ of Notre Dame — A scattering mechanism arising from the charge dipoles at the oxide/III-V semiconductor interface with different crystallographic orientations is identified. We quantitatively evaluate the effect of interface charge dipoles with angular distributions taking into account the effect of crystallographic orientations on electron transport in semiconductor channels of III-V field-effect transistors. The time-independent distribution of dipoles leads to two effects relevant to transistor operation. They cause shifts in the threshold voltage of III-V MOSFETs. The dipoles also scatter conducting charges at the III-V/oxide interface due to their long-range Coulomb potential. The dipole-scattering-limited mobility decreases with increasing dipole parameters such as the dipole length and dipole density, and dipole angle. Higher electron mobility is obtained for aligned dipoles relative to the angular-oriented random dipoles at the interface. A smaller threshold voltage shift is generated for angular-oriented dipoles over the aligned dipoles at the interface. The charge dipole scattering mechanism can be applied to ALD/InGaAs MOSFETs and also to ALD/Nanowire FETs.

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