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Nature of Charge Compensation Mechanism in Devices with Polar Catastrophe RAPHAEL TSU, WATTAKA SITAPUTRA, UNC Charlotte — Polar catastrophe (PC) is well-known in surface science driving a charge compensation mechanism (CCM) at surface/interface, with properties unfound in natural solids [1]. Combining PC with superlattice and resonant tunneling, new device opportunity is wide opened. The strange results of oscillations in conductance, between two limits of $G = gG_o$ with $g = 2, ...$in units of $G_o = e^2/h = 39\mu S$, and hysteresis, were observed in nano-sized (tens of nm) crystalized silicon in amorphous silicon matrix, having native oxides, can be explained [2]. Recent observation of substantial enhanced mobility for very large transfer of carrier from Gd_2O_3 (100) / Si(100), in the order of $n \sim 10^{20}$ cm^{-3} near the interface may apply to high current MOSFET [3]. The field of PC is dominated by heterostructures. 3D structures are lacking defined interfacial orientation; it is compatible with the CCM incorporating resonant tunneling.

[1] Hwang et al., Nat Mater 11 (2), 103(2012).
[2] Thesis, X. Li, 1993, UNC Charlotte; Thesis, A. Bowhill, 1994, UNC Charlotte; Tsu, Superlattice to nanoelectronics, 2nd (2011) Elsevier
[3] W. Sitaputra, R. Tsu, (2012). Submitted.

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