

Abstract Submitted
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Quantum Tunneling with Space Charge Effects in Thin Insulating Gaps.¹ SNEHA BANERJEE, PENG ZHANG, ECE, Michigan State University, 48824, USA — When two conductors are separated by sufficiently thin insulating layer, electrical current can flow between them by quantum tunneling. Space charge and electron exchange correlation potential in the insulating gap influence this current transport significantly. These effects are important to high current diodes, electrical contacts, and electron emitters. Here we present a self-consistent model (SCM) to calculate the tunneling current density in nano- and subnano-meter dissimilar metal-insulator-metal (MIM) junctions including these effects. In dissimilar MIM junctions, the current is polarity dependent. The forward and reverse current-voltage curves and their crossover behaviors are examined in detail in various regimes for a wide range of material properties [1]. We apply this SCM to characterize the current flow in a two-dimensional (2D) tunneling type electrical contacts [2]. We found that current crowding near the edges can be reduced significantly by spatially engineering the interfacial layer. [1] S. Banerjee and P. Zhang, *AIP Adv.*, 9, 085302 (2019), [2] S. Banerjee, J. Luginsland, and P. Zhang, *Sci. Rep.*, 9, 14484 (2019).

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