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Comparison between Simmons's Equations and Quantum Tunneling Experimental Results in A Thin Film LIANXI MA, Blinn College, TEXAS A&M UNIVERSITY COLLABORATION — The theoretical predictions of J.G. Simmons's equations are compared with quantum tunneling experimental results and a discrepancy is found at bias voltage $V_b = U/e$, where U is the barrier's potential height and e is the electron charge. Specifically, he divided the bias voltage into 2 regions: $V_b < U/e$ and $V_b > U/e$, and the I – V characteristics are different in these two regions. The derived equations show a kink on differential conductance $\mathrm{d}I/\mathrm{d}V$ vs. V_b at $V_b = U/e$, because starts at this bias the thickness of the insulation film decreases with V_b in addition to the lowering of the barrier's average height. Therefore, the differential conductance decreases more rapidly in the region $V_b > U/e$ than in the region $V_b < U/e$. However, in tunneling experiment in which Pt is used as conductor and solid neon as insulator, we have not observed such kink even the bias was increased to 4 volts. Our speculation is either 1) there should not be a kink on conductance at $V_b = U/e$ so Simmons's equations need to be modified; 2) the kink should exist but bias voltage is not high enough to observe it in the experiments.

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