

**SPACE CHARGE LIMITED CURRENT
TRANSPORTED THROUGH A SOLID PLACED
INSIDE A VACUUM GAP***

W. Chandra¹, L. K. Ang^{1,2} and W. S. Koh²

¹*School of Electrical and Electronic Engineering, Nanyang
Technological University, Singapore 639798*

²*Institute of High Performance Computing,
Singapore 138632*

Space charge limited (SCL) current is defined as the maximum steady-state electron current density transported across a gap of spacing D and applied voltage V . If the gap is a free space, it is known as the Child Langmuir (CL) law, and the SCL current density is $J \sim V^{3/2}$. On the other hand, if the gap is a solid, it is known as the Mott-Gurney (MG) law with a scaling of $J \sim V^2$. In this paper, we will report a model to determine SCL current density transported in a vacuum gap that is partially filled with a solid or a dielectric. Depending on the length and property of the solid, the voltage scaling ($J \sim V^n$) is between $n = 3/2$ and 2. Comparison of our model with a recent experimental result will be presented.

* Work supported by Singapore MOE grant (2008-T2-1-033) and NTU-EEE-IHPC Computational nanoelectronics and plasmonics.