Abstract Submitted
for the MAR10 Meeting of
The American Physical Society

Breakdown of the Kane model for Zener tunneling WILLIAM VANDENBERGHE, KULeuven / IMEC, BART SORÉE, IMEC, WIM MAGNUS, Univ. Antwerpen / IMEC, GUIDO GROESENEKEN, KULeuven / IMEC — With the introduction of ever smaller dimensions in modern day semiconductor devices, Zener tunneling can no longer be neglected and is affecting device performance. On one hand Zener tunneling is responsible for a leakage current in classical devices such as the MOSFET, on the other hand it provides the drive current for some new devices under investigation such as the tunnel field-effect transistor (TFET). A popular model to calculate the Zener tunneling probability is the Kane model but this model is only valid for Zener tunneling in weak uniform fields. The Kane model can be extended to the case of a non-uniform field using a WKB approximation. But the proper way to calculate the tunneling probability is to derive it directly from the transmission probability of an incoming electron. Using a two-band model we compare the results of a direct calculation of the transmission probability with that calculated using the WKB approximation or the Kane model. We conclude that the Kane model breaks down in the case of high fields and low junction bias.

William Vandenberghe
KULeuven / IMEC

Date submitted: 18 Dec 2009 Electronic form version 1.4