EVC-15

Contribution ID: **248** Type: **Poster**

The Nothing On Insulator Nanotransistor with Diamond Lateral Islands for Electrons Emission in Vacuum

Wednesday 20 June 2018 18:00 (20 minutes)

Abstract: A diamond on insulator structure with a pure tunnelling conduction between source and drain, modulated by a gate bias, is investigated as alternative nano-device. The Nothing On Insulator (NOI) cavity represents the main device body. The Atlas simulations establish superior drain currents and minimum capacitances suitable for THz operation.
Introduction: The NOI nano-device and the lateral field emission devices have in common the Fowler-Nordheim tunnelling; its distinctive features are the nano-diamond islands sizes and a cavity of only 1…4nm, so suitable for co-integration with Diamond/Si-FETs. Also, the dynamic study is a novelty for this device.
Methods: In the first set of simulations the diamond islands have flat walls of 15nmx15nm on insulator of 15nm, a vacuum cavity of 2nm, p-type diamond doping concentration of NA=2E+20cm-3, oxide/diamond interface charge. In the second set, the walls roughness is considered as 3 growths.
Results: The transfer characteristics reveal better ION/IOFF >108, better subthreshold slopes than Si-NOI and prove the main distinctive feature of this nano-transistor versus the lateral diamond field emission devices - the gate control of 0.1 ÷ 10 nA/V. The output characteristics obey to the exponential shape, offering superior ON voltage than Si-NOI. Due to an extremely low area, the simulated capacitances are about 0.5 …0.06aF meaning a cutoff frequency around THz. The conductances start from 10-16S and increase toward 10-5S at 100GHz. The device with roughness improves all these features, sharp growths facilitating the tunnelling.
Discussion: In conclusions, the Diamond-NOI implementation versus Si-NOI offers better: gate breakdown, ON drain-source voltage, ION/IOFF, sub-500mV/dec subthreshold slopes, sub-aF capacitances suitable for THz applications.
Acknowledgements: Supported by grant of Ministery of Research and Innovation, CNCS - UEFISCDI, project number PN-III-P4-ID-PCE-2016-0480, nr 4/2017.

Author: Mr TOPOR, Alexandru (UPB-Romania)

Co-author: Dr RAVARIU, Cristian (UPB-Bucharest)

Presenter: Mr TOPOR, Alexandru (UPB-Romania)

Session Classification: Poster Session Wednesday

Track Classification: Nanometer Structures & Nanotechnology