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Electron emission device made from planar nanowires

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Recently, Thales patented an alternative to tip-plane field emission structure(1) in order to address two main drawbacks: (i) poorly active native apex surface ($\sim R^2$); (ii) complexity to handle out-of-plane structure fabrication with high control over parameters (physical parameters and geometry). Derived from a general capacitive system, a backgated structure was proposed (Fig.1.b). An insulating layer is placed in between a conductive substrate (backgate) and horizontal top NWs. By applying a voltage difference ΔV between NWs and backgate, capacitively induced charges appear on NW sidewalls.

In the ANR PANASSE project, a process has been established to synthesize full-metal-nanowire devices to be characterized in a multiple-probe STM-SEM setup.

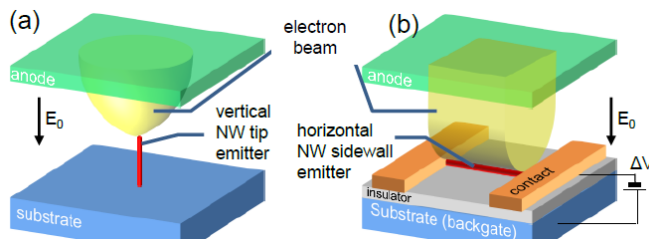


Figure 1. 3D schemes of (left) classical structure of vertical tip emitter and (right) new cathode structure based on backgated NW sidewalls field emitter (not to scale).

Under SEM Monitoring, one probe is in contact with the backgate, one probe is set in contact with a flat-lying nanowire and a third probe acts as anode at a controlled height above the NW to measure the emitted electrons.

The process and its evolution compared to the experimental results will be presented : process details and alternative strategies, scheme of measurements, functional results, future developments.

REFERENCES

1. J.-P. Mazellier and L. Sabaut, Patent req. 1601057, 07/07/2016.