

Resistance measurement of individual Ag nanowires and interconnects

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In the late 1930's, in order to study electron field emission predicted by Fowler and Nordheim[1], Müller pioneered nanotechnology by developing tungsten tips with apex radius of about 100nm[2]. This nanometer range is mandatory in conventional tip to plane field emitter structure to create electrical field enhancement and reach gigavolts per meter (GV/m) at tip surface, resulting in electron field emission.

Since 1990's, the development of nanomaterials has been a major way of revisiting Müller approach by synthesizing nanowires (NW). These NW tip emitters suffer from 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 physical parameters and geometry. NW sidewalls exhibit potential active surface orders of magnitude higher compared to apex surface[3] but due to integration scheme, they suffered a lower field enhancement[3,4]. Recently, Thales patented an alternative to tip-plane field emission structure in order to address this point[5].

Ag NW were tested to study sidewalls field emitters based on NW assemblies in ANR PANASSE project framework. Single NW sidewalls emitters have to be studied for getting physical insight of this new type of emission component. The approach, based on spraying[6], benefits from ex-situ materials commercially available with high degree of monodisperse small radius NW. Significant technical improvements are requested to ensure deposition parameter control for large scale homogeneity, NW orientation control and good electrical properties of the network.

The last point is explored in the present study where Ag nanowires are connected together and directly tested with a multiple-probe STM under SEM supervision [7]. The resistivity of the nanowires and the resistance of their interconnects could be determined. Higher voltages allow to monitor the evolution of the electrical resistance and to test different strategies of interconnections between the nanowires.

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