Seebeck coefficient of AuGe thin films for thermoelectric applications in organic nanoscale devices

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We experimentally study the thermoelectric properties of Au_xGe_{1-x} thin film alloys, close to the metal-insulator transition[1], with the goal of obtaining an element with good thermal sensor electrical properties for integration into nanoscale organic devices.

Based on finite element simulations and by taking into account all spurious thermoelectric effects[2], we have revealed a Seebeck coefficient of the thin film alloy very close to that of Au thin films. Simultaneously we have observed good electrical properties of the thin film alloy allowing to use it as a high resolution thermometer.

As a proof of principle, we have demonstrated the possibility to integrate such an element as the top electrode of a large area vertical molecular junction, embedding thin (5−10 nm) molecular layer, device in which the AuGe film simultaneously fulfills the functions of a local heater and thermometer.

[1]Dodson, B. W., McMillan, W. L., Mochel, J. M., & Dynes, R. C.. Metal-insulator transition in disordered germanium-gold alloys. *Physical Review Letters 46*(1), 46. (1981)

[2]Bakker, F. L., Flipse, J., & van Wees, B. J. Nanoscale temperature sensing using the Seebeck effect. *Journal of Applied Physics*, *111*(8), (2012)

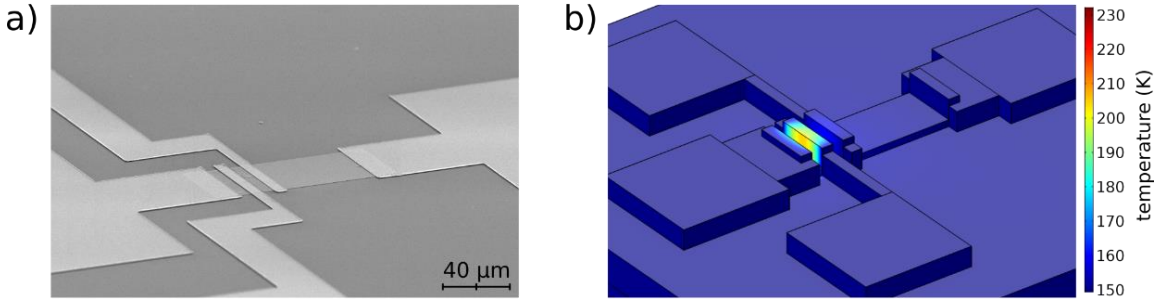

Figure 1 : a) : SEM image of a device intended to measure the Seebeck coefficient of an Au_xGe_{1-x} thin film alloy. b) Simulated three dimensional color plot of the temperature in said sample for an applied voltage Vab of 2V between the a and b contacts at a temperature T=150 K of the environment.