Single Molecule Conductance Measurements under High Temperatures in Vacuum

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Temperature-controlled single molecule measurements have become more and more feasible by break junction methods. [1] Many experimental studies trend to conduct single molecule tests in low temperatures [2]. In contrast, little attention had been paid on dynamics between single molecule and atomic electrode tips in homogeneous thermal surroundings that would cause time-course changes of the conductance. Here we probed thousands of Au-ODT-Au junctions at different temperature conditions using microfabricated MCBJ in vacuum. By combining room- and high-temperature data, we show that the dominant contacting mechanism.

We report on statistical investigation of single-molecule detection mechanisms under high temperatures in vacuum. Current traces recorded while the junction is stretched reveal plateaus below $1G_0$ due to the formation of single-ODT bridging between electrodes. Conductance histograms made from 1K~10K traces reveal a well-defined peak that agrees well with previous measurements in ambient conditions and allows an unambiguous measurement of single molecule conductance in the vacuum from room temperature(300K) to High temperature(420K).We observed that the temperature caused distinct conductance differences by time as we corresponding the histograms of traces. Specifically shifting peaks and gradually narrowing down time span of molecular conductance might reveal a unique molecular contacting mechanism in high-temperature.

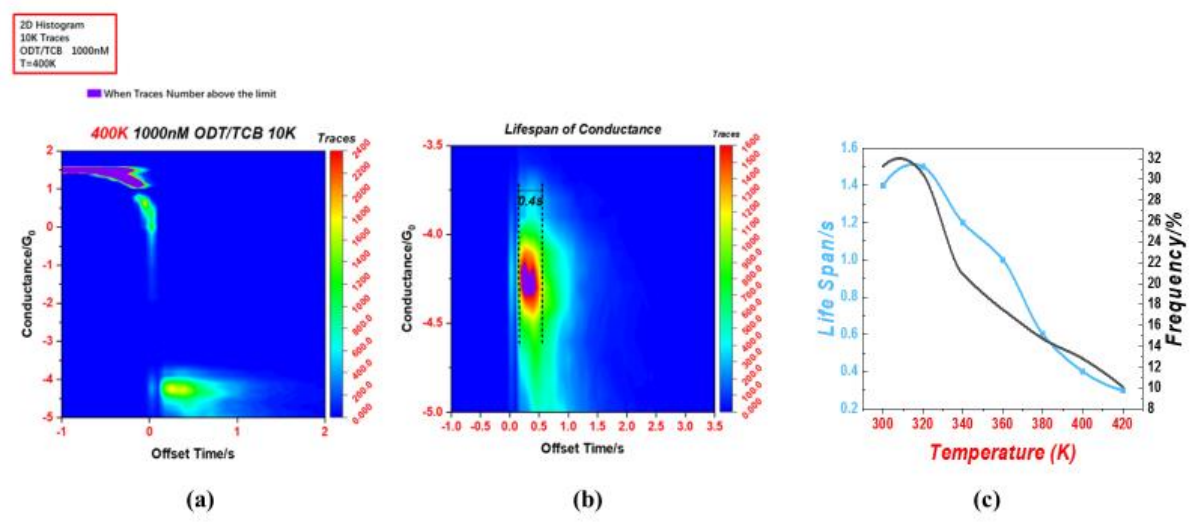

Figure1. (a) 2D histogram of 10000traces ODT measurement **(b)** Lifespan of ODT molecular signals **(c)** Statistical trend between temperature and detection factors

References

[1] Hannu Hakkinen /DOI： 10.1038/NCHEM.1352

[2] Riccardo Frisenda.etc/DOI:10.1021/acs.accounts.7b00493