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Seminar

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Investigation of nanoscale resistive switching devices

One of the recent topics nowadays is to find new materials, which are capable of resistive switching phenomena [1]. For the future applications there are numerous requirements for resistive switching devices. For instance, the high reliability and endurance are the most desirable features of any utilized electronic device.
Here I demonstrate stable resistive switching behaviour in metallic Ag-AgI-PtIr nano-junctions at room temperature. The role of the biasing frequency and amplitude on the switching parameters were investigated in case of thin layer silver iodide.
In addition, industrial devices are expected to be fast comparing to the present-day CMOS technology. Thus, we developed a high frequency measurement system for thin layer memristors. The ability of changing the resistance state with voltage pulses up to gigahertz frequency ranges is demonstrated.
Furthermore, an electronical device requires the proper investigation of noise properties. Thus, the noise analysis on memristors is essential. Our group developed a measurement system for obtaining information about the shot noise and 1/f noise of the examined sample.
One of the disadvantage of the point contact nanojuctions in STM setup is the poor mechanical stability, which can be solved using planar arrangement. The key for creating planar nanogap structures defined by electromigration techniques (for example over SiOx [2]) is the so-called graphene fishing technique [3]. The application of graphene offers not only arbitrary defined structures, but leaves the examined switching mechanism rather unaffected also.

[1] D. B. Strukov, G. S. Snider, D. R. Stewart and R. S. Williams, The missing memristor found, Nature, Springer Nature, 453, 80-83 (2008) [2] L. Pósa, M. El Abbassi, P. Makk, B. Sánta, C. Nef, M. Csontos, M. Calame, and A. Halbritter, Multiple Physical Time Scales and Dead Time Rule in Few-Nanometers Sized Graphene–SiOx-Graphene Memristors, Nano Letters 17 (11), 6783-6789 (2017) [3] J. Kang, D. Shin, S. Bae and B. H. Hong, Graphene transfer: key for applications, Nanoscale, Royal Society of Chemistry (RSC), 4, 5527 (2012).

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