Lateral Perovskite Memristors with Graphene contacts

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We present a lateral memristive device based on an all-inorganic metal-halide perovskite and graphene. Graphene is used as low barrier contact material for the semiconducting $CsPbBr_3$ channel [1]. The solution processed perovskite provides a polycrystalline structure with grain sizes of up to 1-2 µm. The top view of the device schematic is depicted in figure 1a and a corresponding optical micrograph in figure 1b. Also, the IV characteristics of a device with contact spacing of 8 µm is shown in figure 2a and has strong non-linearity and memristive behaviour. Overall, a varid contact spacing from 2 to 18 µm has been used and a clear dependence of the total resistance on the spacing is found, demonstrating, that the main contribution to the total resistance comes from the channel. Memristive behaviour has been observed before in perovskite-based materials and it is caused by ion movement in the material through the electrical field between the contacts [2]. The drift of ions inside the perovskite channel leads to a partial decomposition of the material, as most likely the halide Br^--ions as well as the Cs^+-ions are moving [2]. Therefore, a pn-junction is formed laterally in the device leading to the diode like behaviour [3]. In this poster we will present a detailed analysis of the graphene contacts to the perovskite, the memristive behaviour and the potential of this device for different applications.

References

[1] J. Yun et al., ACS Appl. Mater. Interfaces 2020, 12, 3093
[2] B. Jeong et al., Adv. Mater. 2021, 2100486
[3] X. Wang et al., Nano Lett. 2017, 17, 8, 4835

Figures

a. b.

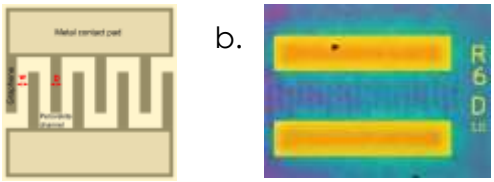

Figure 1: a. Schematic of the memristive device. The perovskite is deposited all over the graphene fingers and the metal contact pads. W describes the channel length and D the width of the graphene fingers. b. Microscope image of a memristive perovskite device.

a. b.

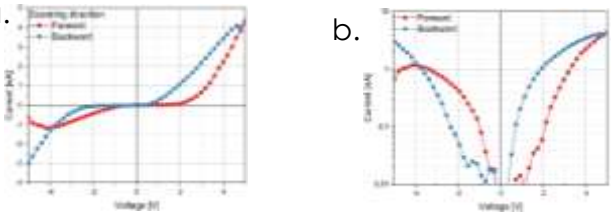

Figure 2: IV curve of the memristive device measured forward and backward. The channel length is 8 µm. a. A diode-like shape can be seen from the IV-curve. b. IV plot in logarithmic scale where the hysteresis of the output current is shown.