**Halogen semiconductors in neuromorphic information processing**

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In typical information processing devices – such as modern computers – there is an explicit division between the processing units and the memory units. Memristor, a fundamental circuit element, offers combination of these two functionalities. For this reason, the memristor is a game changer, changing computations paradigm – acting at the same time as memory and computation unit. Multilevel resistive switching, depending on the resolutions, can be treated as almost continuous, analog switching. This, in turn, makes single memristive device similar to a connection between biological neurons – a neural synapse – making it possible to construct neural network (NN). Compared to software instances of NN, physical ones operate with no discretization of signals and information - exactly as real life neurons do.

The quest for the discovery of physical memristive device dates back to the 70's of the XXth century. First working implementation has been introduced as a layered sandwiched device based on TiO2. From this very moment, several controversies have arisen upon these revelations. Yet each year new materials are chosen as the potential candidates for new memristors.

Our research group has already found functionalized semiconductor with desired properties and behaviour. Strong candidates are lead and bismuth iodide-based hybrid materials – with addition of methylammonium ions. In presented work we show that these perovskite-like materials are ideal building blocks for the artificial synapses with short-term memory. The relatively easy preparation and modification steps make these materials attractive from the processing point of view and prospective large-scale production of thin layer devices.

Although the memristance of perovskites has been already described, we present theoretical results for modified perovskite precursor ink with carbon materials – including single- and multi- walled carbon nanotubes (SWCNT, MWCNT) or graphene oxide forms (GO). Such changes influence directly the hysteresis curves, which indicates memristive character. Another strategy is to functionalize semiconductor with non-stoichiometric polymeric forms of carbon nitride (C3N4). Such addition can induce photo responses.