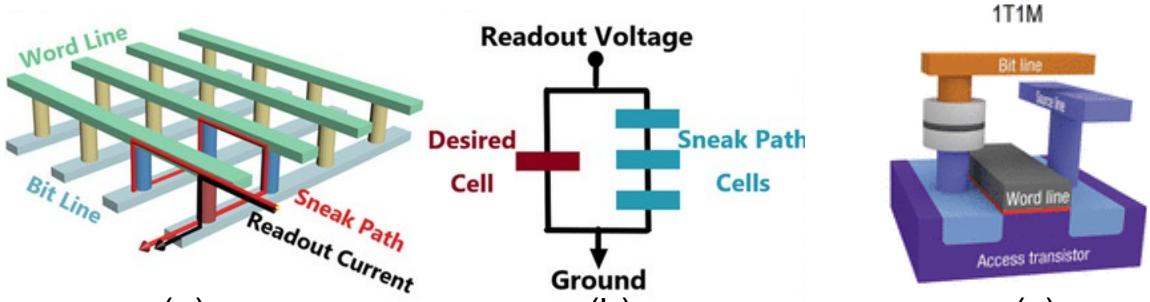
Master Thesis:
Investigation of electrical characteristics of inkjet-printed 1-tranistor-1-memristor structure

Karlsruhe Institute of Technology
Institute of Nanotechnology

Inkjet-printed memristors are gaining increasing interest in printed electronics due to their unique resistive switching characteristics in a non-volatile manner. They are regarded as novel memory devices enabling promising applications such as in-memory computing (IMC). The mainstream of implementing memristive IMC is a crossbar structure (Figure a), where each memristor is defined by a pair of perpendicular word- and bit-line. However, a fully passive crossbar confronts a severe cross-talk problem named sneak path (Figure b). A selective devices, e.g., a transistor, is regarded as a effective solution to sneak path problem when put in series with a memristor, which is known as 1-transistor-1-memristor (1T1M) configuration (Figure c).



(a) (b) (c)

Start: as soon as possible Post date: 07/2024

The first objective of this thesis is to develop an inkjet-printed 1T1M cell consisting a in-house well studied memrisror and electrolye-gated field-effect transistor. Next, electrical characterizations will be performed to evaluate the key figures of the merit of the inkjet-printed 1T1M cell, including the memory window, operation voltage, switching speed, data retention, and maximum switching cycles. The results will eventually facilitate the implementation of memristive IMC based on 1T1M building blocks.

The following skills are preferred but not all of them mandatory:

- Knowledge about semiconductor physics
- Knowledge in solution-processable organic-/inorganic thin films
- Experience in device characterization of semiconductor devices
- Experience in data-analysis with Python

This thesis is adapted for students from the following courses:

- **Electrical engineering**
- **Physics**
- **Material sciences**

Contact:
Prof. Dr. Jasmin Aghassi-Hagmann (jasmin.aghassi@kit.edu) or
Dr. Gabriel, Cadilha Marques (gabriel.marques@kit.edu) or
Hongrong, Hu (hongrong.hu@kit.edu)