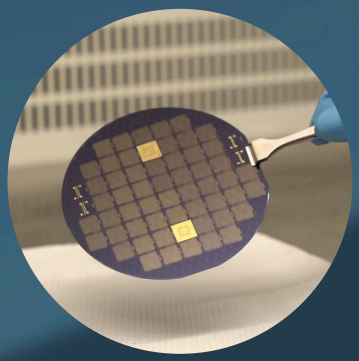
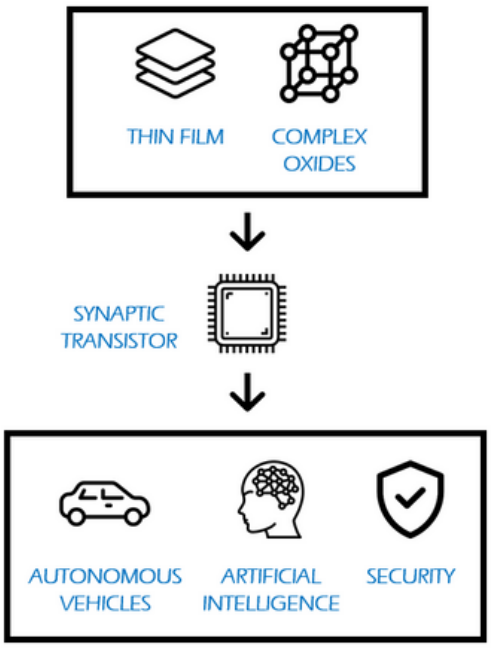


SYNAPTIC TRANSISTORS FOR NEUROMORPHIC COMPUTING

BASED ON NEW GENERATION SOLID STATE IONIC CONDUCTORS

THE CONCEPT



ADDED VALUE

- Analog and non-volatile synaptic behavior
- Robust and stable

TRL

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CONTACT

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PRODUCT DESCRIPTION

- **Three-terminal synaptic transistor** based on solid oxide thin films
- Mimics the **efficient operation of our synapses**
- Analog and non-volatile modulation of channel's conductance is achieved through voltage-controlled oxygen ion insertion
- Advanced electrolyte allows oxygen ion movement at **low temperature**
- BEOL compatible with **traditional microelectronic industry**
- Potential to be substantially more efficient than traditional transistors

APPLICATIONS

- High demand computing applications: AI, autonomous vehicle, image recognition, language understanding
- Microelectronic sector, i.e. neuromorphic and stochastic computing, non-volatile memories for data storage
- Magneto-ionic switching

DESIRED PARTNERS

Semiconductor industry, microelectronic integrators, Silicon intellectual property and design houses, SW/HW designers, and integrated device manufacturers.

EXPECTED BENEFITS

- Multilevel synaptic transistor and memory
- Compatible with semiconductor industry
- Non-volatile elements
- Independent of atmospheric conditions

technical details

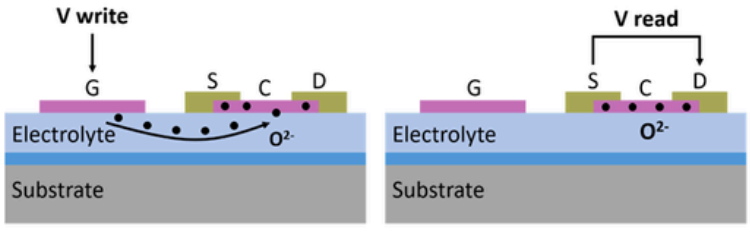
INNOVATION SOLUTION

The technology, inspired by nature, is a synaptic transistor or a non-volatile memory based on a solid oxide ion gating to be applied to neuromorphic computing.
Its nonvolatile and analog characteristics allow to overcome traditional von Neumann architecture for future in-memory computer design. The use of oxygen ions for the modulation of channel's conductance overcome the limitations on stability and integration of current synaptic transistors. The main disruption of this technology is the solid oxide-ion thin film electrolyte able to work at low temperature. This feature opens the door to a full new range of applications in microelectronic sector, such as autonomous vehicles, diagnosis or security.

MAIN BENEFITS

- Three terminal transistor that mimics the behavior of human synapses
- The analog and non-volatile behavior permits in-memory design, overcoming traditional von Neumann computer's architecture
- High data storage and high efficiency for reducing energy consumption of emerging applications, such as AI
- Exploiting oxygen ions to modulate transistor's conductance ensure the operation in any atmospheric condition
- Large operation temperature range is possible thanks to the superior oxygen ion conductivity of the thin film

WORKING PRINCIPLE



IMPLEMENTATION

A proof of concept demonstrated for multistage process system based on solid oxide ionics.

Patent number WO2022263659

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