

2DSPIN-TECH



A game changer for computer memory

As the use of information technology increases rapidly, it is necessary to develop new non-volatile, faster, and energy-efficient electronics. Spintronic technologies open routes to achieve this. However, devices based on conventional materials are still too inefficient for applications in consumer electronics. Graphene and other 2D materials can be the solution to current technology roadblocks – it's where the project 2DSPIN-TECH enters the room.



It is a breakthrough in
the field of spintronics.

World of spintronics

Spintronics shows us a brand new world, full of magnetic possibilities. 2DSPIN-TECH is here to demonstrate controllable spin-orbit torque in 2D materials.

The flow of charged electrons can generate electrical current, and in addition to this charge it also carries a spin. In the same way traditional electronics uses charge current to represent information as zeros and ones, the spin current can be used to represent the same binary data in spintronics. Such devices should have quicker switching times and lower power consumption than conventional devices because spin can be manipulated faster and at lower energy costs than charge can.

The proposed van der Waals heterostructure spintronic devices consisting of 2D topological spin-orbit materials and 2D magnets will enable exceptionally efficient spin-orbit torque (SOT) functionality with low current densities and ultrafast magnetization switching speed.

It is a quantum leap within the field of spintronics.



Sustainable solutions

Spintronics has the potential to realise high performance with ultralow power consumption and fast speeds. It offers a way to advance technologies in various areas, such as quantum computing and energy harvesting, which are key to realising a low-carbon society.

- **Low-Power Electronics:** Spintronic devices can operate with significantly lower power consumption compared to conventional semiconductor devices based on charge transport. This is because spintronics utilises the spin of electrons, a quantum property, to manipulate the flow of information, reducing the amount of energy required for switching and processing.
- **Non-Volatile Memories:** Spintronic memory technologies eliminate the need for constant power consumption to maintain memory, leading to significant energy savings, especially in battery-powered devices.
- **High-Speed Data Processing:** Spintronic devices can achieve faster switching speeds compared to conventional semiconductor devices, enabling faster data processing and communication. This can reduce the time required for computations and data transfer, leading to energy savings in data centres and other high-performance computing environments.
- **Reduced Joule Heating:** Spintronic devices generate less heat during operation compared to conventional semiconductor devices. This reduces the need for cooling systems, which consume energy and contribute to greenhouse gas emissions.
- **Sustainable Materials:** Spintronic devices often require less material to manufacture compared to conventional semiconductor devices. Additionally, the use of 2DM in spintronics can further reduce the amount of material required, leading to a smaller environmental footprint.





Join the 2DSPIN-TECH movement

The consortium: 7 partners from 5 European countries! The project brings together pioneering and world-leading experimental and theoretical researchers and a company in the field of spintronics and 2D materials in Europe.

Project coordinator: Professor. Saroj Dash, Chalmers University of Technology.



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