

Adaptive Opto-Neuromorphic Device Based on Monolayer MoS₂ for Extreme-Temperature Cognitive Operations

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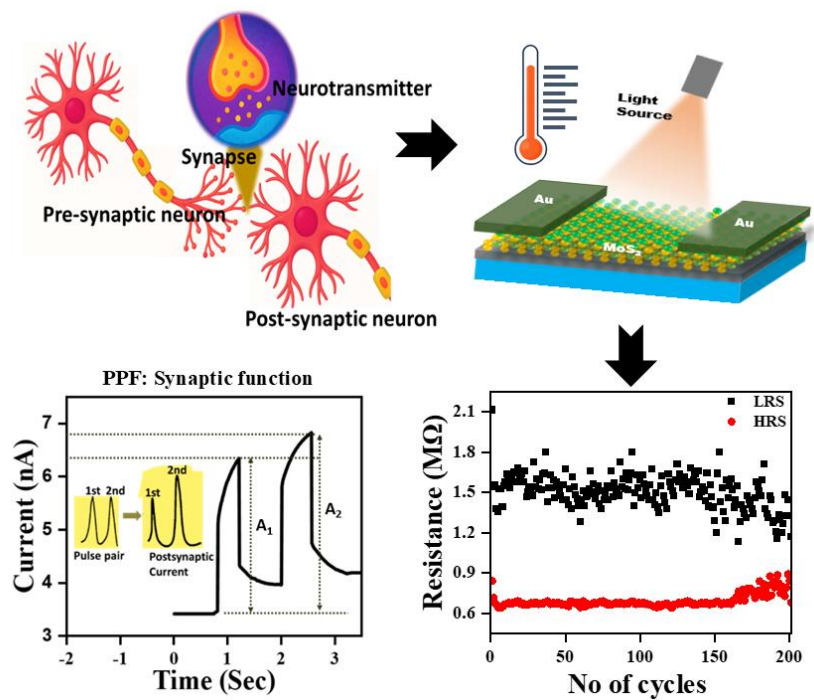
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Abstract

High-temperature neuromorphic devices are becoming increasingly essential as technology advances to support space exploration and withstand extreme conditions, such as those found in factories. To overcome this need, the researchers are devising technologies that imitate the human brain structure and operation. In this work, we present a scalable

neuromorphic device based on a monolayer of MoS₂ that demonstrates operation at 100°C. The device portrays excellent electrical performances, mostly due to the great thermal stability of monolayer MoS₂ and its mechanical flexibility. Among these performances are low power consumption, fast switching, high resistance ratio, low switching voltage, and long stable endurance (~10³ cycles). Besides, the device mimics neuromorphic behaviour by embedding the synaptic plasticity that is the major functional property of biological neural networks, thus allowing advanced cognitive computing in extreme environments. This is the first step toward a combination of materials science and neuromorphic computing, and it clears the way for smart resilient electronics that could survive in a variety of harsh conditions. This research aims



to achieve a significant breakthrough in the field of high-temperature electronics, paving the way for the development of future high-performance electronics that can meet the demands of modern technology.

Keywords: 2D, TMDCs, Neuromorphic, Brain inspired, MoS₂