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Spiking Behavior in Memristors with Shared Top Electrode Configuration

Authors : B. Manoj Kumar, C. Malavika, E. S. Kannan

Abstract : The objective of this study is to investigate the switching behavior of two vertically aligned memristors connected by a shared top electrode, a configuration that significantly deviates from the conventional single oxide layer sandwiched between two electrodes. The device is fabricated by bridging copper electrodes with mechanically exfoliated van der Waals metal (specifically tantalum disulfide and tantalum diselenide). The device demonstrates threshold-switching behavior in its I-V characteristics. When the input voltage signal is ramped with voltages below the threshold, the output current shows spiking behavior, resembling integrated and firing actions without extra circuitry. We also investigated the self-reset behavior of the device. Using a continuous constant voltage bias, we activated the device to the firing state. After removing the bias and reapplying it shortly afterward, the current returned to its initial state. This indicates that the device can spontaneously return to its resting state. The outcome of this investigation offers a fresh perspective on memristor-based device design and an efficient method to construct hardware for neuromorphic computing systems.

Keywords : integrated and firing, memristor, spiking behavior, threshold switching
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