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Ternary Synaptic Plasticity Arising from Memdiode Behavior of TiOx Single Nanowire[1] DESHUN HONG, YUANSHA CHEN, JIRONG SUN, BAOGEN SHEN, Chinese Academy of Sciences, Beijing, GROUP 3 OF MAGNETISM LABORATORY, BEIJING NATIONAL LABORATORY FOR CONDENSED MATTER PHYSICS TEAM — Electric field-induced resistive switching (RS) effect has been widely explored as a novel nonvolatile memory over the past few years. Recently, the RS behavior with continuous transition has received considerable attention for its promising prospect in neuromorphic simulation. Here, the switching characteristics of a planar-structured TiOx single nanowire device were systematically investigated. It exhibited a strong electrical history-dependent rectifying behavior that was defined as a "memdiode". We further demonstrated that a ternary synaptic plasticity could be realized in such a TiOx nanowire device, characterized by the resistance and photocurrent responses. For a given state of the memdiode, a conjugated memristive characteristic and a distinct photocurrent can be simulaneously obtained, resulting in a synchronous implementation of various Hebbian plasticities with the same temporal order of spikes. These intriguing properties of TiOx memdiode provide a feasible way toward the designing of multifunctional electronic synapses as well as programmable artificial neural network

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