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Electrochemical manipulation of two-dimensional materials YI-JUN YU, FANGYUAN YANG, Fudan University, XIU FANG LU, YA JUN YAN, University of Science and Technology of China, YONG-HEUM CHO, Rutgers University, LIGUO MA, XIAOHAI NIU, Fudan University, SEJOONG KIM, YOUNG-WOO SON, Korea Institute for Advanced Study, DONGLAI FENG, SHIYAN LI, Fudan University, SANG-WOOK CHEONG, Rutgers University, XIAN HUI CHEN, University of Science and Technology of China, YUANBO ZHANG, Fudan University — The electronic properties of a variety of two-dimensional (2D) materials can be modulated by electrochemical modifications on mesoscopic scale. Here we demonstrate a proof-of-concept ionic field-effect transistor (iFET), which is based on reversible modifications of the electronic properties of a wide range of layered materials (e.g. 1T-TaS₂ and 2H-TaS₂) through gate-controlled electrochemical reactions with mobile ions in the electrolyte. By fine-tuning the electrochemical reactions, we can switch between Mott phase, superconducting phase, metallic phase and insulating phase in a single 1T-TaS₂ iFET device. Such technique opens up new possibilities in searching for the novel state of matter in 2D materials.

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