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THE QUASI-SOLID STATE SINGLE-ATOM TRANSISTOR: PERSPECTIVES FOR QUANTUM ELECTRONICS AT ROOM TEMPERATURE

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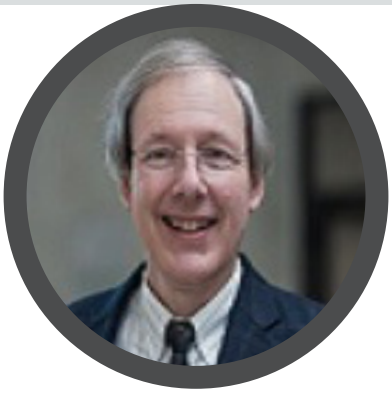
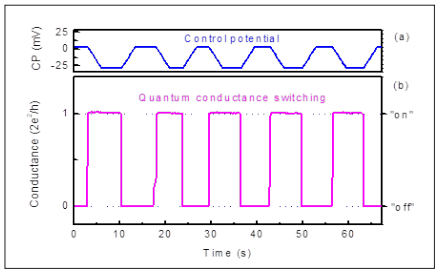


A quasi-solid state atomic-scale quantum conductance switch is demonstrated which allows to open and close an electrical circuit by the controlled and reproducible reconfiguration of individual silver atoms within an atomic-scale junction. The only movable parts of the switch are the contacting atoms. The device which is fabricated by electrochemical deposition of silver atoms within a gel electrolyte is entirely controlled by an external voltage applied to an independent third gate electrode. Controlled switching was performed between a quantized, electrically conducting "on-state" exhibiting a conductance of G0 = $2e^2/h$ (≈ 1/12.9kΩ) or pre-selectable multiples of this value and an insulating "off-state". The device, which reproducibly operates at room temperature, represents an atomic transistor or relay, opening intriguing perspectives for the emerging fields of quantum electronics and logics on the atomic scale.

Image



F Xie, A Peukert, Th Bender, Ch Obermair, F Wertz, Ph Schmieder and Th Schimmel (2018) Quasi-Solid-State Single-Atom Transistor, Advanced Materials, in press.

Biography

Prof. Dr. Thomas Schimmel holds a doctorate in physics from the University of Bayreuth. So far he had professorships at universities in Munich and Linz. Since 1996 he teaches at the Institute of Applied Physics of Karlsruhe University, Karlsruhe Institute of Technology (KIT), and participates in numerous research projects. He is the initiator and spokesman of the research network "Functional Nanostructures" in Baden-WÃ¼rttemberg. Professor Schimmel is head of the working group for nanostructuring and scanning probe technology.