

研究论文

微芯片上Ag₂S电化学纳米开关的构筑及电学测量的初步研究

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收稿日期 2006-1-12 修回日期 网络版发布日期 2007-1-9 接受日期

摘要 初步探索了利用电化学方法“自下而上”地构筑了Au/Ag/Ag₂S-Au固体电化学纳米开关, 并确定了较适宜的开关工作条件. 小于1 nm的Ag₂S-Au间隔是Ag₂S开关器件的关键结构, 以保证电子的量子隧穿和间隔中Ag凸起的生长与收缩. 测量结果表明, Ag₂S开关转换具有较好的可逆性和稳定性, 开关转换电流相差3个数量级以上.

关键词 [Ag₂S](#) [纳米开关](#) [电化学](#) [电沉积](#)

分类号 [0646](#)

A Preliminary Study on Fabrication and Electronic Measurements of a Ag₂S Nanoelectrochemical Switch

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Abstract Nanoelectronics is an important area of research in nanotechnology and nanoscience, in which nano structures with electronics functionality are designed and fabricated. In this paper, a Au/Ag/Ag₂S/Au solid-state electrochemical nanoswitch was constructed by using electrochemical methods from the “bottom-up” approach. The Ag₂S nanoelectrochemical switch fabricating procedure includes three steps: (1) A silver layer was electrodeposited on one of a pair of facing Au electrodes which was separated with about 2 μm gap width; (2) the surface of the silver layer was then converted to Ag₂S by electrochemical oxidation in a basic Na₂S solution; (3) the gap was narrowed down to about 1 nm by electrodepositing Au atoms on to the other one of the facing pair electrodes. It is demonstrated that such a device can switch between “on” and “off” states at room temperature and in air. A gap of 1 nm is the key structure of the switch. The Ag₂S switch works by controlling the formation and annihilation of an atomic Ag-bridge at the tip point between two electrodes. The reversibility and stability of the switch is satisfactory with a current difference between “on” and “off” states more than three orders of magnitude.

Key words [Ag₂S](#) [Nanoswitch](#) [Electrochemistry](#) [Electrodeposition](#)

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