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Transport properties and non-volatile memory application of self-assembled nanoparticle array by microtubules MEI XUE, K.L. WANG, Device Research Laboratory, Department of Electrical Engineering, University of California, Los Angeles, JING ZHOU, BRUCE DUNN, Department of Material Science & Engineering, University of California, Los Angeles — A method of self-assembly of gold nanoparticles with the diameter of around 1nm is developed by the use of bio species (microtubule) and transport properties of nanoparticle arrays are investigated. Via self-assembly, the attachment sites of gold nanoparticles to the microtubule can be controlled. The density of the gold nanoparticles in our experiments achieved is on the order of $10^9 \text{cm}^{-2}$ and can be extended to as high as $10^{13} \text{cm}^{-2}$. A transport bi-stability is observed in a sandwich structure of Au/MT + gold nanoparticle array / P+ Si substrate. On the basis of detailed analysis of the temperature and electrical field dependences, a band model incorporating electron-tunneling is suggested to explain the observed bi-stability and other transport characteristics. The retention time is also measured to be larger than $10^5$s. The operation and endurance of this memory device are confirmed. With its simple structure and the compatible fabrication process with conventional MOS, this MT/Au nanoparticle array holds a great potential for memory applications.

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