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Photo-induced Electrical Properties of Metal-oxide Nanocrystal Memory Devices

Dong Uk Lee[1], Seong gook Cho[1], Eun Kyu Kim[1,*], Young-Ho Kim[2]

[1]Quantum-Function Research Lab. and Department of Physics, Hanyang University, Seoul 133-791, Korea
[2]Division of Materials Science and Engineering, Hanyang University, Seoul 133-791, Korea

The memories with nano-particles are very attractive because they are promising candidates for low operating voltage, long retention time and fast program/erase speed. In recent, various nano-floating gate memories with metal-oxide nanocrystals embedded in organic and inorganic layers have been reported. Because of the carrier generation in semiconductor, induced photon pulse enhanced the program/erase speed of memory device. We studied photo-induced electrical properties of these metal-oxide nanocrystal memory devices. At first, 2～10-nm-thick Sn and In metals were deposited by using thermal evaporation onto Si wafer including a channel with n^+ poly-Si source/drain in which the length and width are 10 μm each. Then, a poly-amic-acid (PAA) was spin coated on the deposited Sn film. The PAA precursor used in this study was prepared by dissolving biphenyl-tetracarboxylic dianhydride-phenylene diamine (BPDA-PDA) commercial polyamic acid in N-methyl-2-pyrrolidon (NMP). Then the samples were cured at 400^{o}C for 1 hour in N atmosphere after drying at 135^{o}C for 30 min through rapid thermal annealing. The deposition of aluminum layer with thickness of 200 nm was followed by using a thermal evaporator, and then the gate electrode was defined by photolithography and etching. The electrical properties were measured at room temperature using an HP4156a precision semiconductor parameter analyzer and an Agilent 81101A pulse generator. Also, the optical pulse for the study on photo-induced electrical properties was applied by Xeon lamp light source and a monochromator system.

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