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Electrical and structural characterization of memory devices with laser fabricated nanocrystals

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Abstract

Nonvolatile memory devices with metal nanocrystals (NCs) have the advantages of higher programming/erasing efficiency, lower operating voltage, wide work function and larger charge capacity. Metal NCs with high work-function such as Platinum (Pt) and gold (Au) are preferable materials [1] due to the deep voltage wells they create. A major challenge in manufacturing NCs is particles with small dimensions uniformity and high density. Fabrication of NCs via Laser Annealing (LA), is an alternative and promising technique because of its versatility and ease of application, offers a high degree of control of metal NC formation as well as advantages of defect minimization in the oxide or at the NC oxide interfaces [2,3]. In this work we present the results concerning electrical and structural characterization of memory devices consisting of n-Si\$SiO_2$\$Y_2O_3$\Al incorporating Au NCs and their characteristics. Laser annealing with a KrF laser was used to obtain uniformly spaced and small in dimensions (5-20 nm) Au NCs.

Capacitance vs Voltage (C-V), Conductance vs Voltage (G-V) and Current vs Voltage (I-V) measurements of n-Si\SiO2\Au(NCs)\Y_2O_3\Al devices show a large memory window and a reduced leakage current.

Our results indicate that laser annealing leads to MOHOS-type flash memory devices with good electrical and structural characteristics due to the creation of high quality and high homogeneity metal NCs.

References

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