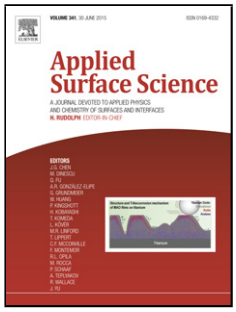
Accepted Manuscript



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PII: S0169-4332(17)30750-X
DOI: http://dx.doi.org/doi:10.1016/j.apsusc.2017.03.091
Reference: APSUSC 35467

To appear in: *APSUSC*

Received date: 20-11-2016
Revised date: 4-3-2017
Accepted date: 9-3-2017

Please cite this article as: Sattam Alotaibi, Krishna Nama Manjunatha, Shashi Paul, A study of Selenium nanoparticles as Charge Storage Element for Flexible semi-transparent memory Devices, Applied Surface Science http://dx.doi.org/10.1016/j.apsusc.2017.03.091

A study of Selenium nanoparticles as Charge Storage Element for Flexible semi-transparent memory Devices

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Abstract

Flexible Semi-Transparent electronic memory would be useful in coming years for integrated flexible transparent electronic devices. However, attaining such flexibility and semi-transparency leads to the boundaries in material composition. Thus, impeding processing speed and device performance. In this work, we present the use of inorganic stable selenium nanoparticles (Se-NPs) as a storage element and hydrogenated amorphous carbon (a-C:H) as an insulating layer in two terminal non-volatile physically flexible and semi-transparent capacitive memory devices (2T-NMDs). Furthermore, a-C:H films can be deposited at very low temperature (< 40˚C) on a variety of substrates (including many kinds of plastic substrates) by an industrial technique called Plasma Enhanced Chemical Vapour Deposition (PECVD) which is available in many existing fabrication labs. Self-assembled Se-NPs has several unique features including deposition at room temperature by simple vacuum thermal evaporation process without the need for further optimisation. This facilitates the fabrication of memory on a flexible substrate. Moreover, the memory behavior of the Se-NPs was found to be more distinct than those of the semiconductor and metal nanostructures due to higher work function compared to the commonly used semiconductor and metal species. The memory behavior was observed from the hysteresis of current-voltage (I-V) measurements while the two distinguishable electrical conductivity states ("0" and "1") were studied by current-time (I-t) measurements.

Keywords: Amorphous carbon; Selenium Nanoparticles; Flexible memory; two terminal flash memory.

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Introduction