



Zolile Wiseman Dlamini

*Central University of Technology, President Brand
Street, Bloemfontein, Free State, South Africa*

Digital data storage device using sodium alginate

Abstract: The current state of environmental contamination caused by discarded electronic waste (e-waste) is troubling. The infiltration of e-waste into aquatic and subterranean environments can harm living organisms, including humans, due to the presence of harmful compounds. The mitigation of e-waste can be achieved through the incorporation of biodegradable materials in the manufacturing of electronic devices. Memory devices are components of the electronics industry and significantly contribute to the increasing e-waste due to the use of semiconducting materials and other heavy metals. This study examines sodium alginate, a biodegradable polymer, for its potential use in the novel biodegradable memory technology known as resistive switching memory (ReRAM). A sodium alginate solution was applied by the drop casting process onto a PCB substrate with copper traces. The solution was allowed to dry at room temperature to form a film. Next, a conductive silver ink based pen was used to draw silver traces on the film. These silver traces were oriented perpendicular to the copper traces, thus forming an array of “copper-sodium alginate-silver” device at the intersection points. The device underwent testing with the memristor characterisation apparatus. The voltage was applied between the copper and silver electrodes and a current through the device was measured. The device exhibited two unique resistance states: a high resistive state and a low resistive state, indicating its capability for digital data storage. This study has shown the manufacturing of a ReRAM device with a reduced environmental footprint, produced by a more cost-effective approach that did not require heating and utilized minimum electricity.

Keywords: Resistive switching memory, biodegradable, sodium alginate, electrical conduction, BioReRAM

Biography: Zolile Dlamini serves as a senior lecturer at the Central University of Technology and does research in the discipline of physics. His research focuses on biodegradable resistive switching memory devices. He is a member of the South African Institute of Physics and a co-researcher at the University of South Africa. He also, shares a funding from the National Research Foundation's African University Twinning Program with the Namibian University of Science and Technology. Zolile has published research articles, book chapters, and patents concentrating on digital data storage utilizing biodegradable materials and bio-composites.