CALIFORNIA STATE SCIENCE FAIR
2013 PROJECT SUMMARY

Name(s)
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Project Number
J0907

Project Title
Gelatin-based Memristive Device

Abstract

Objectives/Goals
The goal of this experiment was to determine if it is possible to create a macro-scale (as opposed to nano-scale) device that exhibits memristive behavior using table-top materials.

Methods/Materials
1. Create two gelatin-filled glass tubes by inserting each end of the glass tube into pre-congealed gelatin and use household screws on the ends as electrodes to make good electrical contact with the gelatin. One tube consists of lime gelatin (a conductor) and the other tube contains half plain and half lime gelatin (plain gelatin is an insulator).

2. The lime gelatin device is the control device expected to act as a resistor. The half lime/half plain gelatin device is the test device expected to behave as a memristor.

3. Cycle each device to plus and minus 7.5 volts by 0.5 volt increments, first as a #forming step# to establish the device#s memristive character, and on subsequent cycles, record the voltage/current value at each point with a multimeter to determine if the device shows memristive behavior.

4. Plot the values and determine (a) if the lime gelatin device acts as a normal resistor, and (b) if the half lime/half plain device shows the #pinched hysteresis# loop characteristic of a memristor.

Results
1. The half lime/half plain device acted as a memristor, exhibiting the characteristic voltage/current pinched hysteresis loop.
2. The lime gelatin device showed a linear voltage/current plot characteristic of a resistor.

Conclusions/Discussion
Conclusion: The data is consistent with the device being a memristor. To my knowledge this is the first memristor produced on a macroscale.

Discussion: Memristors have been nanoscale devices because memristance is related to voltage and the device cross section. As the cross section gets smaller, the effect grows. The first memristors are devices with sizes in the 100nm range and there was some question as to whether any reasonable voltage could produce the same effect in a device with a cross section of 3mm.

Summary Statement
This project created what may be the first macroscale memristor while using common household materials.

Help Received
I first saw memristors during the #Take Your Kid To Work# day at HP last summer. Members of the memristor design team provided answers to what materials might work for this experiment. My Dad was an extra set of hands in running the experiment and creating the gelatin cells - something harder than it