Abstract Submitted
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A Time-Temperature Transistor - An Application of Aging Dynamics GREGORY KENNING, Indiana University of Pennsylvania — Aging dynamics occur as systems far from thermodynamic equilibrium evolve towards equilibrium. We have produced a magnetic nanoparticle system composed of Co nanoparticles, which self-assemble during Co deposition on Sb. At a particular time in the formation of the nanoparticles, they are encased in a layer of Sb producing a system far from equilibrium. Magnetization vs. temperature measurements as well as Magnetic Force Microscopy (MFM) indicates that the nanoparticles initially have a large magnetic moment. We observe, as a function of time, an approximately 80% decay in the sample magnetization and an approximately 50% decay in the DC electrical resistivity. MFM suggests that the magnetization decay proceeds from the magnetic nanoparticles losing their net moments possibly due to spin rearrangement. Evidence also suggests that the initial magnetic moments, drive the Sb layer semiconducting. As the net moments of the magnetic nanoparticles decrease, the Sb reverts back to its semi-metal behavior with the accompanying decrease in the electrical resistivity. The magnetization and resistance decays follow the same Arrhenius type behavior. By varying the Co layer thickness, the Arrhenius parameters can be tuned. We have been able to tune the parameters making these materials excellent candidates for sensors for electronically monitoring the age and lifetime of perishable foods.

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