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16. Physics

University of Central Oklahoma

05. Mathematics and Science

16. Physics

05.16.01 Attenuation Coefficient of Sunflower Oil

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East Central University

Accurate and repeatable attenuation coefficient is useful to get more realistic phantoms. Phantoms are used to analyze ultrasound images. An ultrasound technique using sunflower oil, 1, 2, and 4 MHZ transducers including the Al block was used. We obtained the attenuation coefficient for sunflower oil using the slope method. At constant temperature and velocity, adjusting the reflector for maximum amplitude, the amplitudes (A1 and A2) and the distance between them were collected using D-mode. The collected data was plotted as attenuation versus twice distance, which gave us the value of the attenuation coefficient from the slope. The value of the attenuation coefficient for the sunflower oil using 1, 2, and 4MHZ transducers were found to be 0.0097, 0.007430, 0.005585 dB/mm MHZ respectively. Our values of the attenuation coefficient were of the same magnitude as GAMPT reported. GMAPT found the attenuation coefficient to be 0.025 dB/mm MHZ. The quality of the oil varies for different lot numbers and brands. Thus, we should not expect our results to match our correlation coefficient was 0.95 for1MHZ, 0.96 for 2MHZ and 0.88 for 4MHZ, which exactly indicate our method is robust.

05.16.02 Storage of Solar Energy in a Proton Exchange Membrane Fuel Cell

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Cameron University

We make a proton exchange membrane fuel cell (PEMFC) that can utilize excess solar energy stored in the form of hydrogen in order to produce electricity at a later time, for example at night time. We compare the hydrogen production from crystalline silicon based photovoltaic cells with the dye sensitized solar cells. The purpose of this research is to find an efficient combination of the hydrogen production from solar energy and a PEMFC.

05.16.03 Caffeine Determination in Energy Beverages

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An Ultraviolet-visible method was used to analyze and determine how much caffeine is in energy beverages. Using a UV-visible instrument would allow for simple determination, but there is background interference. The goal in this experiment is to use a UV-visible method and perform a second derivative of the spectra to eliminate background. Pure caffeine was diluted and used to calibrate the UV-1700 PharmaSpec spectrophotometer. Caffeine exhibits maximum absorbance at 272nm. A second derivative of the spectra permits elimination of the background. Plotting the difference between the maxima at 248nm and minima at 272nm versus concentration of caffeine results in a linear plot with y=0.003625mg-1cm-1. To test this method, known amounts of pure caffeine were added to beverages such as tea, powerade, and Sprite. The amount of caffeine determined by this method resulted in an average percentage error of 2% for tea, 4% for powerade, and 2.9% for Sprite. The method in this work is used to analyze energy drinks for caffeine.

05.16.04 Solution Based Deposition of Antimony Doped Tin Oxide Films

John, Dale

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A solution based deposition method was used to prepare thin films of antimony doped tin oxide (ATO). The ATO was prepared by dissolving a one to three ratio of $SbCl_3$ and $SnCl_2 \cdot 2H_2O$ separately in 6M HCl. The two solutions without precipitate where then combined and lowered to a PH of 4 by adding ammonium hydroxide drop wise. The solution was then washed till a silver nitrate test of the wash water would no longer test positive for Cl. Films where then dried at 100˚C for 24 hours. Once dry the films where annealed at 500˚C for 3 hours. Typical film thickness is approximately 1μm. The purpose of preparing these films was to examine the effects of thermal and electrical annealing followed by hydrogenation on the resistance of ATO. Thus far thermal annealing results in a film resistance 1.5MΩ. These results indicate that the solution based method can be used in producing electro-optical devices.

05.16.05 Charged Particles in Chaotic Magnetic Fields

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As new questions arise as of how particles travel through space, new methods of answering these questions can be implemented. By using chaotic streamlines in the Arnold-Beltrami-Childress (ABC) flows, particles can be set in motion at any point on an imaginary 2π x 2π x 2π cube. Trough computer codes written to track the different paths these particles can take, the paths can be observed. A chaotic magnetic field is recreated and introduced through a computer code as well as the magnetic field that has a determined start and end position. Histograms and Poincaré sections are created to record the information. The purpose of this experiment is to observe the charged particles on the chaotic magnetic field and on the constant magnetic field. Through tracking the distances the particle traveled during an allocated time the diffusion of particles in magnetic fields can be further understood, however, not completely. Furthermore these fields can widely occur in nature, in astrophysical environments, such as solar fares, solar corona, solar wind, and also in laboratory plasmas, thus, with further studies these fields can help understand them.