Non-linear Optical Properties of Bi1-xCaxFeO3 Nanostructured Powder in Chitosan Matrix with a Predicted Tunability in Their Band Gaps

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Climate change has caused scientists to develop eco-friendly technological devices, vehicles, and home appliances. Multiferroic films have been gaining researchers' attention lately because of their ability to convert solar energy, thanks to their above-band gap generated photovoltages (Nuraje, 2012). This research focuses on the evaluation of the optical properties of BFO particles added to a Chitosan matrix. The samples with BFO nanoparticles were used as an experimental group, while the pure Chitosan, and water and acetic acid were used as a control group to calibrate some of the equipment used. The samples were doped with 2%, 5% and 7% Calcium, so the Oxygen vacancies in the rhombohedral structure could be filled. The methodology implemented begins with the dissolution of the precursor salts in acetic acid and water for 1 hour. The resulting solution was left to dry for 12 hours at 80°C. Powder samples were thermally treated for 30 minutes at up to 700°C. Later, the BFO was mixed with the Chitosan through mechanical agitation for 24 hours. Filtration and sonication lasted up to 2 hours. The solution was dried in an oven at 35-40 ºC for 4 days. The characterization measures used were XRD, UV-vis, Photoluminescence measurement, and a conductometer. As the Calcium composition increased, the conductivity decreased, which means the resulting material is an insulator. The samples achieved a band gap of 4.3 eV. The ideal applications for this research project are solar cells and/or batteries. However, this material may have many more applications due to its flexibility.