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Synthesis & Characterization of Europium, Yttrium and Iron-based Nanoparticles

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Currently there is a high demand for materials that exhibit multifunctional properties, that is, synthesized compounds with a unique property and an adequate effect that meets various applications in the industrial world. The present study is focused on the synthesis and characterization of two types of nanomaterials: metal oxides and nanomaterial nanocomposites (ferrite and garnet), which were synthesized under the solid state reaction method, using citric acid ($C_6H_8O_7$) as an oxidizing agent in each reaction. On the one hand, the green route was used in the manufacture of metal oxide nanoparticles, where two natural extracts and two different precipitating agents were handled. On the other hand, the garnet and ferrite nanocomposites were made using different doping concentrations. The synthesis of the nanoparticles was carried out at an approximate temperature of 180ºC until crystalline powders were formed. For the elimination of unwanted residues, the samples were subjected to a temperature between 400ºC - 600ºC for 4 hours.

The characterization of the nanomaterials was carried out using the following techniques: X-ray Diffraction (XRD) (Bruker, D8 Advance), Scanning Electron Microscopy (SEM) / Energy Dispersive X-rays (EDX) (JSM-6390VL SEM –EDX), Fourier transform infrared (FTIR) spectroscopy (PerkinElmer, Frontier), and Raman spectroscopy (Thermo Scientific). The results obtained show hexagonal structures for the metal oxide nanoparticles and a crystal size between 24.44 to 33.74 nm. The garnet nanocomposites present a cubic structure and a crystallite size equal to 57.42 nm. Finally, the ferrite nanocomposites exhibit both cubic and rhombohedral-type structures and have a size ranging from 12.48 nm to 67.73 nm.