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Fabrication, structure and magnetic properties of Ce1-xFexO2 nanostructures

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Ce1-xFexO2 nanofibers (NFs) and nanoparticles (NPs) (x=0, 0.08 and 0.10) were prepared by electrospinning and the simple solution process, respectively. Each of sample was calcined at 500, 600, 700, and 800 ˚C. The calcined samples were characterized by X-ray diffraction (XRD), Transmission Electron Microscopy (TEM), Scanning Electron Microscopy (SEM), X-ray Photoelectron Spectroscopy (XPS), X-ray Absorption Spectroscopy (XAS) and Vibrating Sample Magnetometer (VSM). Both of XRD and TEM with Selected Electron Diffraction (SEAD) analysis indicated that the Ce1-xFexO2 nanostructures have a cubic structure without any secondary phase. TEM was shown nanofibers of ˜30-60 nm while SEM was shown nanoparticles of ˜9-40 nm. The as-spun samples were exhibited a diamagnetic behavior, whereas the calcined of Ce0.90Fe0.10O2 nanofibers samples exhibited ferromagnetic behavior with the specific magnetizations of 0.04 –0.32 emu/g at 10 kOe. XAS spectra was showed the valent state of mixed Fe3+ and Fe2+ in the Ce1-xFexO2 samples indicating oxygen vacancies in the nanostructures. Similarly, XPS spectra confirmed that there are oxygen vacancies in the nanostructures. These oxygen vacancies play an important role to induce room temperature ferromagnetism (RT-FM) in the calcined of Ce1-xFexO2 nanostructures. Our results indicated that the ferromagnetic properties of Ce1-xFexO2 system is intrinsic and is not a result of any secondary magnetic phase or cluster formation.

Author: Mr SONSUPAP, Somchai (School of Physics, Suranaree University of Technology, Nakhon Ratchasima, Thailand)

Co-author: Prof. MAENSIRI, Santi (School of Physics, Suranaree University of Technology, Nakhon Ratchasima. NANOTEC-SUT Center of Excellence on Advanced Functional Nanomaterials, Suranaree University of Technology, Nakhon Ratchasima, Thailand.)

Presenter: Mr SONSUPAP, Somchai (School of Physics, Suranaree University of Technology, Nakhon Ratchasima, Thailand)

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