

# Effects of V doping on electronic and magnetic properties of inverse spinel Fe<sub>3</sub>O<sub>4</sub> thin films

Seung-li Choi, Kwang Joo Kim\*, Jae Yun Park\*\*

\*Department of Physics, Koukuk University,

\*\*Department of Materials Science and Engineering, University of Incheon

In the present work, effects of vanadium (V) doping on the electronic and magnetic properties of magnetite (Fe<sub>3</sub>O<sub>4</sub>) have been investigated. Spinel compounds V<sub>x</sub>Fe<sub>3-x</sub>O<sub>4</sub> were prepared as thin films by a sol-gel method and probed by x-ray diffraction (XRD), vibrating sample magnetometry (VSM), conversion electron Mossbauer spectroscopy (CEMS), and x-ray photoelectron spectroscopy (XPS) in comparison with Fe<sub>3</sub>O<sub>4</sub>.

XRD data showed that the V<sub>x</sub>Fe<sub>3-x</sub>O<sub>4</sub> films remain cubic up to x = 1.0 with a slight increase of the lattice constant. VSM measurements indicate an increase of saturation magnetization (M<sub>S</sub>) by a small amount of V doping (x = 0.14) compared to that of the Fe<sub>3</sub>O<sub>4</sub> as shown in Fig. 1. For the higher V doping, the M<sub>S</sub> of the V<sub>x</sub>Fe<sub>3-x</sub>O<sub>4</sub> films decreases below that of the Fe<sub>3</sub>O<sub>4</sub> films. Detailed CEMS and XPS investigations were performed for figuring out cationic distribution and explaining the variation of magnetic properties of the V<sub>x</sub>Fe<sub>3-x</sub>O<sub>4</sub> films.

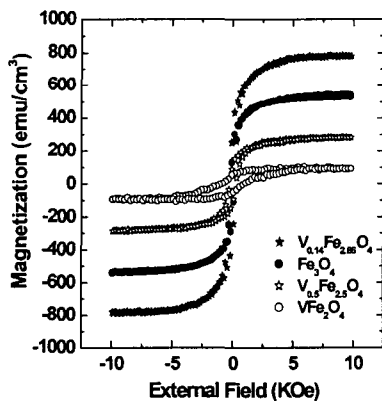


Figure 1. VSM data for V<sub>x</sub>Fe<sub>3-x</sub>O<sub>4</sub> films at room temperature.