Atomic Image of Diluted Magnetic Semiconductor $Zn_{1-x}Mn_xTe$ Obtained by X-ray Fluorescence Holography

Shinya Hosokawa[a], Naohisa Happo[b], Kouichi Hayashi[c], Toru Ozaki[a], [a]*Faculty of Engineering, Hiroshima Institute of Technology.* [b]*Faculty of Information Sciences, Hiroshima City University.* [c]*Institute for Materials Research, Tohoku University, Japan.* E-mail: hosokawa@cc.it-hiroshima.ac.jp

From an X-ray diffraction [1], the lattice constant of diluted magnetic semiconductor $Zn_{1-x}Mn_xTe$ linearly changes with varying x (Vegard's law), while an XAFS results [2] showed almost unchanged Mn-Te and Zn-Te bond lengths (Pauling's rule). This discrepancy led to a question of how the large the large $MnTe_4$ tetrahedra can be squeezed into the small $ZnTe_4$ lattice.

X-ray fluorescence holography (XFH) is a new technique that allows one to investigate a three-dimensional local image around a specific element. The sample was irradiated by intense X-rays of certain energies beyond the Mn K absorption edge at BL37XU/SPring-8 in order to obtain the Mn K_α fluorescence hologram [3]. A three-dimensional atomic image around the Mn central atoms was derived from the hologram using Barton's algorithm. The nearest- and third-nearest-neighbour Te atoms were clearly visualized. However, the second-nearest-neighbour Zn or Mn atoms are barely visible in this image due probably to a highly distorted cation Zn(Mn) sub-lattice.

[1] Yorder-Short D.R., et al., *J. Appl. Phys.*, 1985, **58**, 4056. [2] Happo N., et al., *J. Phys.:Condens. Matter,* 1996, **8**, 4315. [3] Hosokawa S., et al., *Jpn. J. Appl. Phys*, 2005, **44**, 1011.

Keywords: three-dimensional image reconstruction, x-ray fluorescence spectroscopy, magnetic semiconductors