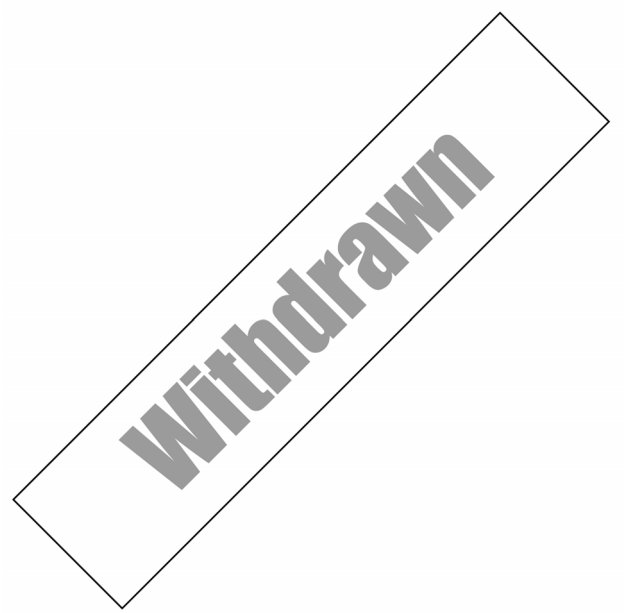
BC04



BC05

Grwoth and Nanoscale Magnetic Properties of Ferromagnetic Nanowire Encapsulated Inside Carbon Nanotubes

Yasuhiko Hayashi[1]*, T. Fujita[2], T. Tokunaga[3], B. Jang[1], M. Tanemura[1], and G. A. J. Amaratunga[4]

[1]Department of Frontier Materials, Nagoya Institute of Technology, Gokiso-cho, Showa-ku, Nagoya 466-8555, Japan
[2]WPI Advanced Institute for Materials Research, Institute for Materials Research,Tohoku University, Aoba-ku, Sendai, Miyagi 980-8577, Japan
[3]Department of Quantum Engineering, Nagoya University, Furo-cho, Chikusa-ku, Nagoya 464-8601, Japan
[4]Department of Engineering, University of Cambridge, 9 JJ Thomson Avenue, Cambridge CB3 0DE, United Kingdom

*Corresponding author: Yasuhiko Hayashi, e-mail: hayashi.yasuhiko@nitech.ac.jp

Aligned ferromagnetic nanowire encapsulated inside carbon nanotubes (CNTs) has significant potential in high density magnetic recording media due to their nanoscale size and strong anisotropic property, leading to small bit size [1]. Moreover, the tube structure provides an effective barrier against oxidation effect

Here we present a growth and characterization of self-assembled aligned Pd_xCo_{1-x} alloy nanowire encapsulated MWCNT arrays on Si by dc bias-enhanced plasma CVD with C_2H_2 and NH_3. Off-axis electron holography in the transmission electron microscope (TEM) was used to correlate the magnetic microstructure of magnetite Pd_xCo_{1-x} alloy nanowire in individual MWCNTs [2].

The phase shift caused by the magnetic flux is clearly observed outside the tube indicating a magnetization parallel to the tube axis by electron holography, as shown in Fig. 1. And the magnetic field lines show a magnetic symmetry of the metal nanowire encapsulated inside MWCNTs. The powerful technique of the electron holography in the TEM enabled us to obtain the saturation magnetization of "each" and the magnetic "interaction" between Pd_xCo_{1-x} alloy nanowire encapsulated inside MWCNTs by calculating the magnetic field lines.

This work is supported by Grant-in-Aid for Scientific Research (B) under contract number 50314084.

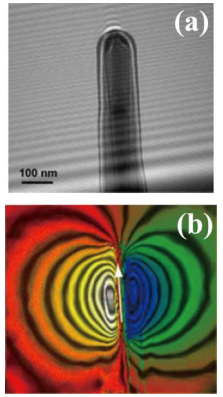


Fig. 1. Hologram taken from the nanorod filled inside MWCNT (a), color contour map of the corresponding magnetic component (b).

REFERENCES

[1] J. Bao *et al.*, Adv. Mater. 14, 1483 (2002).
[2] T. Fujita *et al.*, J. Appl. Phys. 101, 014323 (2007).
[3] T. Fujita *et al.*, Appl. Phys. Lett. 88, 243118 (2006).