Magnetic Force Microscopy of Carbon Nanotube Peapods

Po-Wen Chiu,[1] Toshiya Okazaki,[2] Kazutomo Suenaga,[3] Shangfeng Yang,[4] Shihe Yang,[4] David Carroll,[5] Hisanori Shinohara[2] and Siegmar Roth[1]

[1]Max-Planck Institut for solid state research
Heisenbergstr. 1
Stuttgart 70569
Germany

[2]Department of Chemistry
Nagoya University
Nagoya 464-8602
Japan

[3]National Institute of Advanced Industrial Science and Technology
(AIST)
Tsukuba 305-8565
Japan

[4]Department of Chemistry, Hong Kong University of Science and Technology
Clear Water Bay
Kowloon Hong Kong
China

[5]School of Materials Science and Engineering,
Clemson University
Clemson, SC 2963
USA

Nanomagnetic elements are intriguing because of their fundamental science and their potential practical application in ultrahigh density storage. Carbon nanotube encapsulated with rare earth metallofullerenes is a new class of magnetic structures which have periodic individual metal atoms sitting inside the tubes (“magnetic peapods”). In pure dysprosium there is a long range (heli)-magnetic order, Dy@C82 is paramagnetic. An interesting question arises on whether a magnetic force microscope (MFM) would be sensitive enough to react to the magnetic force between the magnetic moments of the dysprosium ions and the magnetic coating of a atomic force microscope (AFM) tip. In this contribution, we will show the observation of nanodomains in a thin bundle of magnetic peapods and the MFM tip stray field induced magnetic reversal.