QD14

Thermal Effects on the EPR Dosimetriccharacter of Irradiated Human Tooth Enamel with X- and γ-rays

K.C. Heo*[1], Ch.I. Ok[2], D.G. Park[1], J.W. Kim[2], and W.W. Kim[1]
[1]Korea Atomic Energy Research Institute, Yusung P.O. Box 105, Taejon, 305-600, South Korea
[2]Department of Physics, Pusan National University, Busan 609-735, Korea
*Corresponding author: kycheo@kaeri.re.kr, Phone: +82 42 868 2023, Fax: +82 42 868 8549

The effect of thermal annealing on the irradiation-induced Electron Paramagnetic Resonance (EPR) signals in tooth enamel was researched. The intensity of EPR signal due to CO_2^- radical on post-irradiation annealing (irradiation before sample annealing) in comparison with irradiative event increased by more than about 7 % that of pre-irradiation annealing(annealing before sample irradiation). Also, this EPR dosimetric character was affected to some extent with the measurement temperature and thermal treatment of the samples. The intensity and lineshapes of the EPR signals of the samples was depended upon the measurement temperature and the thermal annealing condition with irradiated samples. The influences of these in EPR spectra areimportant to EPR dosimetry and EPR archaeological dating.

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QE01

Underlying Mechanism of Ultrafast Switching of Vortex Core Orientation in Ferromagnetic Nanodots

Ki-Suk Lee, Konstantin Y. Guslienko, Jun-Young Lee, and Sang-Koog Kim*
Research Center for Spin Dynamics and Spin-Wave Devices, Seoul National University, Seoul 151-744, Republic of Korea
Nanospintronics Laboratory, Department of Materials Science and Engineering, College of Engineering,
Seoul National University, Seoul 151-744, South Korea
*Corresponding author: sangkoog@snu.ac.kr, Phone: +82 2 880 5854, Fax: +82 2 885 1457

The question of how fast magnetization reversal occurs is the central issue in the field of nanomagnetism and related dynamics. In particular, the dynamic properties of a magnetic vortex (MV) in nano-size magnetic elements are of growing interest because of its non-trivial physics as well as promising applications to ultrafast, high-density information storage and spintronics [1]. Quite recently, micromagnetic simulation studies [2-4] and experimental verification [5] showed ultrafast vortex-core (VC) reversals, however, the underlying mechanism of the core reversal phenomenon has not been clarified yet.

We conducted micromagnetic simulations of dynamics of an equilibrium MV state in a Permalloy cylindrical dot of $2R$ = 300 nm diameter and L = 10 nm thickness in a response to an oscillating in-plane magnetic field $\mathbf{H}(t)=A\sin(2\pi\nu t)y$ over a wide range of the field frequency ν and amplitude A, covering the gyrotropic eigenfrequency (ν_0= 330 MHz) and saturation field (A_s = 500 Oe). The MV dynamical response depends essentially on ν and A. In a certain range of the parameters ν and A, ultrafast reversal (10 ps time scale) of the VC orientation occurs via the process of the creation and annihilation of a vortex-antivortex (V-AV) pair. With increasing H, the entire vortex structure starts to deform, the in-plane curling magnetization becomes elongated, and the VC structure becomes distorted. When the core deformation is maximized, the V-AV pair nucleates having parallel core orientations, which are opposite to the original MV core orientation. Then the new AV structure and the original V structure are getting closer by their attractive force and annihilate each other. Immediately, strong spin wavesare radiated from their annihilation site. In the meantime, the new vortex movesfar away. Consequently, the final state is the MV of switched core orientation.

The underlying mechanism of the VC reversal offers a principal opportunity to use the vortex cores for ultrafast information recording at frequencies in the sub-THz range as well as sources of the high-amplitude spin waves [2,3] that could be used in magnetic logic devices.

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