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Crystallographic and Magnetic Properties of Neutron Irradiated RPV Steel

Hyo Duk Nam[1], Sang Ryul Lee[2], Sung Jin Kim[2]

[1]School of Electronical Engineering and computer Science, Yeungnam university 712-749, Korea
[2]Department of Physics, Yeungnam University, Gyongsan 712-749, Korea

Corresponding author: lsl7998(@yumail.ac.kr, Phone: +82 53 810 2343, Fax: +82 53 814 6141

The neutron irradiated reactor pressure vessel (RPV) steels at various dose of $0 \sim 10^{18}$ n/cm^2 have been studied with Mössbauer, x-ray diffraction, and VSM. The Mössbauer data showes that the value of magnetic hyperfine field of Fe atom that exist at martensite is 330 kOe at site 1 and 305 kOe at site 2. At room temperature, the total absorption area of Mössbauer spectra with respect to irradiation of neutron is constant for the dose of of $0 \sim 10^{16}$ n/cm^2, while over the dose of 10^{17} n/cm^2 the absorption area decreases rapidly. But the doublet area for the dose of $0 \sim 10^{16}$ n/cm^2 is constant, while over the dose of 10^{17} n/cm^2 it increases with increasing the fluence level of neutron. The value of I.S. and Q.S. at site 1,2 varied slightly with increasing the fluence level of neutron. However at doublet site existing Fe^{3+} state, over the dose of 10^{17} n/cm^2 the value of I.S. and Q.S. increase with increasing the fluence level of neutron. It is noted that over the dose of 10^{17} n/cm^2 the neutron irradiated sample lose crystal structure slowly. The coercivity and remanence of the neutron irradiated samples do not change significantly. But the maximum induction decreasesby 5% at of 10^{18} n/cm^2, compared with that of the as-received sample.

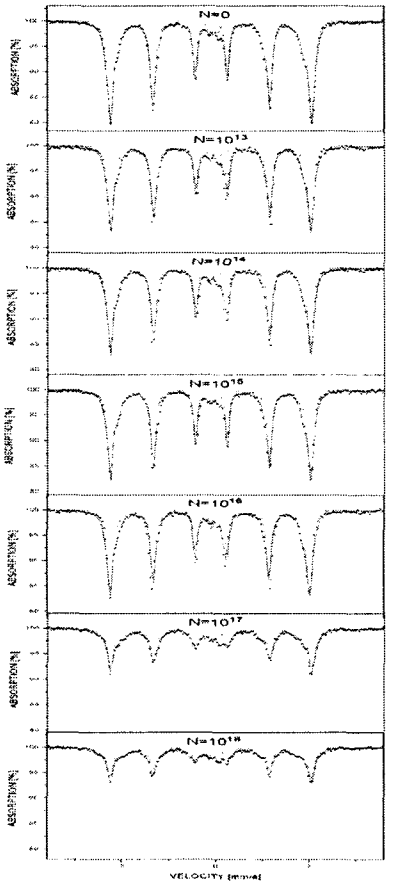

Fig. 1. Mössbauer spectra for the neutron irradiated RPV taken at room temperature at the dose of $0 \sim 10^{18}$ n/cm^2.

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Permittivity Modulation Study of Multiferroic AlN/NiFe/AlN Films

D. S. Hung[1], Y. D. Yao[2], K. T. Wu[3], E. Ding[3,4], and Y. C. Chen[3]

[1]Department of Information and Tele. Engineering, Ming Chuan University, Taipei 111, Taiwan
[2]Department of Materials Engineering, Tatung University, Taipei 104, Taiwan
[3]Department of Physics, Fu Jen University, Taipei 242, Taiwan
[4]Ming Hsin University of Science and Technology, Hsinchu 304, Taiwan

email: ydyao(@phys.sinica.edu.tw

Multiferroic materials showing the coexistence of ferromagnetic and ferroelectric characteristics have been attracting much scientific and technological interest. Aluminum Nitride (AlN) possesses a wide band gap (6.3 eV), a high chemical stability and a good dielectric properties. The complex dielectric permittivity for AlN/NiFe/AlN samples with the thickness of NiFe layer varied from 2 to 20 nm have been measured as a function of frequency from 40 Hz to 30 MHz. The films are fabricated by the reactive sputtering. All samples are deposited on B270 subtracts and measured on Agilent 4294A impedance meter. Because the ferroelectric material is polarized by shifting the orientation of dipole moment from one direction into another direction by an electric field, the adding NiFe ferromagnetic layer greatly enhances their dielectric constant. The AlN/NiFe/AlN thin films show a large shift for the dielectric spectrum compared with the AlN thin films. High dielectric constant in the range 50 - 160 has been observed. Even a 2.5 nm of NiFe layer can go up to 50 in the dielectric constant. The loss tangent also increases as a function of the thickness of NiFe layer and the frequency. Finally, the authors wish to acknowledge support from the Sapintia Education Foundation, and National Science Council under Contract No. NSC-95-2120-M-001-059.