Optimization of planar Hall effect sensor for magnetic bead detection using spin-valve NiFe/Cu/NiFe/IrMn structures

Tu B.D., Cuong L.V., Huong Giang D.T., Danh T.M., Duc N.H.

Department of Nano Magnetic Materials and Devices, College of Technology, Vietnam National University, Hanoi, Viet Nam; Laboratory for Micro-Nano Technology, College of Technology, Vietnam National University, Hanoi, Viet Nam

Abstract: Present paper deals with the planar Hall effect (PHE) of Ta(5 nm)/NiFe(t_f)/Cu(1.2 nm)/NiFe(t_p)/IrMn(15 nm)/Ta(5 nm) spin-valve structures. Experimental investigations are performed for 50 ?? 50 ?m^2 junctions with various thicknesses of free and pinned layer t_f 4, 8, 10, 15, 20 nm and t_p 2, 3, 6, 8, 9, 12 nm. The results show that the thicker free layers, the higher PHE signal is obtained. In addition, the thicker pinned layers, the lower PHE signal. The highest PHE sensitivity S of 15.6 m??/Oe is obtained in the spin-valve configuration with t_f 20 nm and t_p 2 nm. This optimum structure is rather promising for micro magnetic bead detections. ?? 2009 IOP Publishing Ltd.

Author Keywords: Biosensors; Hall effect; Magnetization reversal; Magnetoresistance

Year: 2009

Source title: Journal of Physics: Conference Series

Volume: 187

Art. No.: 12056

Link: Scorpus Link

Correspondence Address: Tu, B. D.; Department of Nano Magnetic Materials and Devices, College of Technology, Vietnam National University, Hanoi, Viet Nam; email: buidinhtu@vnu.edu.vn

ISSN: 17426588

DOI: 10.1088/1742-6596/187/1/012056

Language of Original Document: English

Abbreviated Source Title: Journal of Physics: Conference Series

Document Type: Article

Source: Scopus

Authors with affiliations:

1. Tu, B.D., Department of Nano Magnetic Materials and Devices, College of Technology, Vietnam National University, Hanoi, Viet Nam
2. Cuong, L.V., Laboratory for Micro-Nano Technology, College of Technology, Vietnam National University, Hanoi, Viet Nam
3. Huong Giang, D.T., Department of Nano Magnetic Materials and Devices, College of Technology, Vietnam National University, Hanoi, Viet Nam
4. Danh, T.M., Department of Nano Magnetic Materials and Devices, College of Technology, Vietnam National University, Hanoi, Viet Nam
5. Duc, N.H., Department of Nano Magnetic Materials and Devices, College of Technology, Vietnam National University,

Hanoi, Viet Nam, Laboratory for Micro-Nano Technology, College of Technology, Vietnam National University, Hanoi, Viet Nam

References:

1. Schuhl, A., Dau, F.N.V., Childress, J.R., (1995) Appl. Phys. Lett., 66 (20), p. 2751
2. Dau, F.N.V., Schuhl, A., Childress, J.R., Sussiau, M., (1996) Sensors Actuators, 53 (1-3), p. 256
3. Ejsing, L., Hansen, M.F., Menon, A.K., Ferreira, H.A., Graham, D.L., Freitas, P.P., (2004) Appl. Phys. Lett., 84 (23), p. 4729
4. Ejsing, L., Hansen, M.F., Menon, A.K., Ferreira, H.A., Graham, D.L., Freitas, P.P., (2005) J. Magn. Magn. Mater., 293 (1), p. 677
5. Tu, B.D., Thanh, N.T., Danh, T.M., Duc, N.H., Kim, C.G., (2008) J. Appl. Phys., 104 (7), p. 074701
6. Thanh, N.T., Parvatheeswara, R.B., Duc, N.H., Kim, C.G., (2007) Physica Status Solidi (A), 204 (12), p. 4053
7. O'Handley, R.C., (2000) Modern Magnetic Materials
8. Slonczewski, J.C., (2002) J. Magn. Magn. Mater., 247 (3), p. 324
9. Ralph, D.C., Stiles, M.D., (2008) J. Magn. Magn. Mater., 320, p. 1190
10. Shuai, W., Yuan, X., Ke, X., (2008) Phys. Rev., 77 (18), p. 184430