THE SPIN VALVE TRANSISTOR: A NEW MAGNETO–ELECTRONIC DEVICE

J. Cock Lodder and P.S. Anil Kumar
Information Storage Technology Group, MESA Research Institute,
University of Twente, P.O.Box 217, 7500 AE Enschede, The Netherlands

9.7 cm

Magnetic hard–disk recording density of 20 Gbit/in^2 has been demonstrated a few months ago by using GMR–read sensor in the recording head. In this case the so-called current in plane (CIP) measuring principle was used. However this suffers from several drawbacks and is diminished by shunting and channelling. Measuring with the current perpendicular to the planes (CPP) solves most of the problems, mainly because the electrons cross all magnetic layers. A disadvantage of the CPP mode is that the resistance of the very thin multilayers is too small to be measured by ordinary technologies. Since 1991 various configurations have been proposed. In 1995 a new CPP-MR sensor design was introduced by our group based on the principle of a Metal Base Transistor. In the so-called Spin Valve Transistor (SVT) a GMR multilayer (Co/Cu or NiFe/Co) serves as a base region of an n-Si metal–base structure. A 215 % change in collector current is found in 40 kA/m at 77 K with typical characteristics of a spin valve effect. Recently also large magneto–current at low T was obtained at a very small field range. The device is biased to inject hot electrons from one Si layer through the multilayer, the latter magnetic configuration determining what proportion of this current eventually passes the second Schottky barrier. The latest developments will be reported about the bonding technology during sputtering and lithographic processes to reduce the dimensions of the device to make operation at RT possible. This technology and the realisation of an SVT also establish the feasibility of combining Si technology and spin electronics. In more general the combination of nano magnetism and nano electronics gives the possibility to realise new devices and memory functions.

13.4 cm

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Corresponding author :
J. Cock Lodder

Address for correspondence :
Information Storage Technology Group, MESA Research Institute,
University of Twente, P.O.Box 217, 7500 AE Enschede, The Netherlands

Email address :
J.C.Lodder@el.utwente.nl