Special MRAM poster session

IEDM (3-5 Dec 2018, Hilton Union Square, San-Francisco)

Wednesday afternoon 5 Dec, 2:00pm-5:00pm

Plaza room

For the 3rd consecutive year, a special poster session entirely dedicated to MRAM is organized during IEDM. This session is technically organized by the IEEE Magnetics Society and is embedded in the IEDM 2018 conference. This event will be a great opportunity to foster closer interactions between the microelectronics and magnetism communities. The posters will cover topics including MRAM materials, phenomena, technology (STT, SOT, E-field control), testing, hybrid CMOS/MTJ technology and circuits, and MRAM applications. This year, 32 posters were accepted for presentation.

The list is shown below.

Bernard DIENY and Bruce TERRIS
IEEE Magnetics Society

Presented posters :

1. High-thermal-tolerance reference layer with tungsten spacer layer for perpendicular-anisotropy MTJs

H. Honjo[1,7], S. Ikeda[1,2,4,5,7], H. Sato[1,2,3,4], M. Yasuhira[1,7], and T. Endoh[1,2,4,5,7]

[1]Center for Innovative Integrated Electronic Systems, Tohoku University, Sendai, Japan,
[2]Center for Spintronics Integrated Systems, Tohoku University,
[3]Laboratory for Nanoelectronics and Spintronics, RIEC, Tohoku University,
[4]Center for Spintronics Research Network, Tohoku University,
[5]Graduate School of Engineering, Tohoku University,
[6]WPI-Advanced Institute for Materials Research (WPI-AIMR), Tohoku University,
[7]JST-ACCEL

2. Capping Layer Material Dependence of Magnetic Properties of Free Layer in Perpendicularly Magnetized Magnetic Tunnel Junctions

H. Tomita[1,3], K. Nakamura[1], Y. Tanaka[1,3], K. Nagasaka[1,3], K. Ando[2], S. Bosu[1,3], A. Gomi[1], A. Fukushima[3], H. Kubota[3], K. Yakushiji[3], S. Yuasa[3], H. Maehara[2,3] and N. Watanabe[1]

[1]Tokyo Electron Technology Solutions Limited
[2]Tokyo Electron Limited
[3]National Institute of Advanced Industrial Science and Technology (AIST), Spintronics Research Center[2]

3. Magnetic Tunnel Junctions with MgO Tunnel Barrier Formed by Post-Oxidation Process for STT-MRAM

H. Tomita[1,3], K. Nakamura[1], Y. Tanaka[1,3], K. Nagasaka[1,3], K. Ando[2], S. Bosu[1,3], A. Gomi[1], A. Fukushima[3], H. Kubota[3], K. Yakushiji[3], S. Yuasa[3], H. Maehara[2,3], and N. Watanabe[1]

[1]Tokyo Electron Technology Solutions Limited
[2]Tokyo Electron Limited
[3]National Institute of Advanced Industrial Science and Technology (AIST), Spintronics Research Center

4. Enhancing magnetic materials at the atomic scale using light ion irradiation

L. Herrera Diez[1], M.Sall[1], M.Belmeguenai[2], Y.Roussigné[2], A.Stashkevich[2], S.M. Cherif[2], G.Durin[3], Arianna casiraghi[3], M. Voto[4], L. Lopez-Diaz[4], J.Langer[5], B. Ocker[5] and D. Ravelosona[1,6]

[1] Centre de Nanosciences et de Nanotechnologies, CNRS, Univ. Paris-Sud, Université Paris-Saclay, C2N – Orsay, 91405 Orsay cedex, France.
[2]LSPM (CNRS-UPR 3407), Université Paris 13, Sorbonne Paris Cité, 99 avenue Jean-Baptiste Clément,93430 Villetaneuse, France
[3]Istituto Nazionale di Ricerca Metrologica, Turin, Italy
[4]Departamento Fisica Aplicada, Universidad de Salamanca, plaza de los Caidos s/n E-38008, Salamanca, Spain
[5]Singulus Technology AG, Hanauer Landstrasse 103, 63796 Kahl am Main, Germany.
[6]Spin-Ion Technologies, 91405 Orsay France

5. Correlation between interfacial Dzyaloshinskii-Moriya interaction and interfacial magnetic anisotropy in Pt/Co/MgO structures

Woo-Yeong Kim[1, 2], Hyung Keun Gweon[1], Sang Ho Lim[1], Kyung-Jin Lee[1, 3], and Chun-Yeol You[2†]*

[1]Department of Materials Science and Engineering, Korea University, Seoul 02841, Korea
[2]Emerging Materials Science, Daegu Gyeongbuk Institute of Science & Technology, Daegu 42988, Korea.
[3]KU-KIST Graduate School of Converging Science and Technology, Korea University, Seoul 02841, Korea

6. Ultra-thin polycrystalline $Co_{25}Fe_{75}$ films for perpendicular magnetic tunnel junctions

Ikhtiar, Xueti Tang, Sebastian Schafer, and Mohamad Krounbi

Samsung Semiconductor Inc., New Memory Technology Lab, San Jose, CA, 95134, USA

7. Effects of RIE on the properties of Ta/CoFeB/MgO/Ta film stack

*Yao-Jen Chang1, Shan-Yi Yang1, Yu-Chen Hsin1, Jeng-Hua Wei1, Keh-Ching Huang1, Chih-I Wu1, Zhao-wen Chen2, Yeo-yu Cheng2, Lin-Xiu Ye2, Duan-li Deng1,2, Te-ho Wu2**

[1]EOSL, ITRI, Hsinchu, Taiwan, ROC
[2] Graduate School of Materials Science, National Yunlin University of Science and Technology, Yunlin, Taiwan

8. Low Energy Ion Beam Trimming Step in MTJ patterning

Shuogang Huang, Weiyi Li, Zhimin Wan, Seokmin Yun, Ivan (Skip) Berry, Konstantin Smekalin

Lam Research, 4650 Cushing Parkway, Fremont CA 94538

9. A Patterning Solution by Utilizing Combined Etching for STT-MRAM

Kaidong Xu[1,2], Dongdong Hu[1], Dongchen Che[1], Hongyue Sun[1], Mikhail R. Baklanov[1], Jiale Tang[2], Shiwei Zhuang[2], Lu Chen[1]

[1] Leuven Instruments Co. Ltd (Jiangsu), Pizhou, Jiangsu, China
[2] Jiangsu Normal Univeristy, Xuzhou, Jiangsu, China

10. Numerical Demonstration of Multi-functional MRAM Cell Based on Inertial Magnetic Switching

Xiaoguang Li[1], and Yan Zhou[1]

[1]School of Science and Engineering, Chinese University of Hong Kong, Shenzhen 518172, China
zhouyan@cuhk.edu.cn

11. Micromagnetic modeling of non-uniformities in magnetic tunnel junctions for MRAM Devices

Volvach I.[1], Marko V. Lubarda[1] and Vitaliy Lomakin[1]

[1]ECE Department University of California, San Diego

12. From conventional STT-MRAM to Perpendicular Shape Anisotropy STT-MRAM (PSA-STT-MRAM): Dramatic reduction in temperature variation of anisotropy

N.Perrissin, G.Gregoire, S.Lequeux, L. Tille, N.Strelkov, A.Chavent, S. Auffret, L.Buda-Prejbeanu, R. Sousa, L. Vila, I.L. Prejbeanu and B. Dieny

Univ. Grenoble Alpes, CEA, CNRS, Grenoble INP, INAC-Spintec, 38000 Grenoble, France

13. STT efficiency modulation in double barrier pSTT-MRAM cell with read/write mode control layer

P.Coehlo, J.Chatterjee, A.Chavent, N.Strelkov, S. Auffret, L.Buda-Prejbeanu, R. Sousa, L. Vila, M.Chshiev, I.L. Prejbeanu, B.Dieny and C.Baraduc

Univ. Grenoble Alpes, CEA, CNRS, Grenoble INP, INAC-Spintec, 38000 Grenoble, France

14. Multi-bit MRAM storage cells utilizing serially connected perpendicular magnetic tunnel junctions

Piotr Rzeszut[1], Witold Skowroński[1], Sławomir Ziętek[1], Jerzy Wrona[2] and T. Stobiecki [1,3]

[1] AGH University of Science and Technology, Department of Electronics, 30-059 Kraków, Poland
[2] Singulus technologies, Kahl am Main, 63796, Germany
[3] AGH University of Science and Technology, Faculty of Physics and Applied Computer Science, 30-059 Kraków, Poland

15. Multifunctional magnetic tunnel junction standardized stack as universal spintronic technology for IoT

A. Chavent[1], V. Iurchuk[1], L.Tillie[1], Y. Bel[1], L. Vila[1], U. Ebels[1] R. Sousa[1] B. Dieny[1], G. di Pendina[1], G. Prenat, J. Langer[2], J. Wrona[2], I. L. Prejbeanu[1]

[1] Univ. Grenoble Alpes, CEA, CNRS, Grenoble INP*, INAC-Spintec, 38000 Grenoble, France
* Institute of Engineering Univ. Grenoble Alpes[2]Laboratory on GRMN
[2] Singulus Technologies AG, 63796 Kahl am Main, Germany

16. MRAM Testing Flow for Device Integration in Volume Manufacturing

Siamak SALIMY (1), Gilles ZAHND (1), Nathalie LAMARD (1), Eric MONTREDON (1), Isabelle JOUMARD (2), Antoine CHAVENT (2), Ricardo SOUSA (2), Mathieu DUPREZ (3), Thierry DEVUN (3), Laurent LEBRUN (1), Jean-Pierre NOZIERES (1)

[1]Hprobe, 4 rue Irène Joliot Curie, 38320, Eybens, France
[2]Spintec, CEA 1005 building, 17 rue des Martyrs, 38054 GRENOBLE Cedex 9
[3]Mu-TEST, 8 Impasse de l'Industrie, ZA la Garnasse, 43240 Saint-Just Malmont, France

17. Comprehensive reliability study of STT-MRAM devices and chips for Last Level Cache applications at 0x nodes

Jian Zhu, Yuan-Jen Lee, Huanlong Liu, Son Le, Jodi Iwata-Harms, Sahil Patel, Ru-Ying Tong, Vignesh Sundar, Santiago Serrano-Guisan, Dongna Shen, Renren He, Jesmin Haq, Zhongjian Jeffrey Teng, Vinh Lam, Yi Yang, Yu-Jen Wang, Tom Zhong, Luc Thomas, Hideaki Fukuzawa, Guenole Jan and Po-Kang Wang

TDK Headway, Milpitas, CA, USA, email: jian.zhu@headway.com

18. Digital PUF based Secure Hardware Identity Authentication Using STT-MRAM for Internet of Things

Yao-Tung Tsou, Yu-Chian Chang†, Wei-Chen Chien‡, Sy-Yen Kuo†, and Ching-Ray Chang§*

*Department of Communications Engineering, Feng Chia University, Taichung 407, Taiwan. (Email: yaodong1014@gmail.com)
†Department of Electrical Engineering, National Taiwan University, Taipei 106, Taiwan.
‡Graduate Institute of Applied Physics, National Taiwan University, Taipei 106, Taiwan.
§Department of Physics, National Taiwan University, Taipei 106, Taiwan.

19. Multi Bit Upset detection and correction based on self-robust Non-Volatile C-element

Odilia Coi [1,2], Lionel Torres[2], Gregory Di Pendina[1]

[1]SPINTEC, UMR 8191, (Grenoble Alpes Univ/CEA/CNRS)
[2]LIRMM, UMR 5506, University of Montpellier, CNRS

20. In-memory Direct Processing based on Nanoscale Perpendicular Magnetic Tunnel Junctions

*Kaihua Cao[1,2], Wenlong Cai[1], Yizheng Liu[1], Huisong Li[1], Jiaqi Wei[1,2], Hushan Cui[1,2], Xiaobin He[2], Junjie Li[2], Weisheng Zhao[1,3], Chao Zhao[1,2]**

[1]Fert Beijing Institute, BDBC, and School of Electronic and Information Engineering, Beihang University, 100191 Beijing, P.R. China
[2]Institute of Microelectronics of Chinese Academy of Sciences, 100029 Beijing, P.R. China
[3]Beihang-Geortek Joint Microelectronics Institute, Qingdao Research Institute, Beihang University, 266000 Qingdao, P.R. China
E-mail: zhaochao@ime.ac.cn

21. Reliable, sub-nanosecond spin-orbit torque switching of three terminal magnetic tunnel junctions with in-plane magnetic anisotropy

Shengjie Shi, Lijun Zhu, D. C. Ralph and R. A. Buhrman

Cornell University, Ithaca NY 14850, USA

22. Interfacial control of W/CoFeB/MgO multilayers for high-density SOT-MRAM

Chong Bi[1], Xiang Li[1], and Shan X. Wang[1,2]

[1]Stanford University, Department of Electrical Engineering, Stanford, 94305, United States
[2]Stanford University, Department of Material Science and Engineering, Stanford, 94305, United States
Email: cbi@stanford.edu ; sxwang@stanford.edu

23. Thermal Modeling of FinFET-Driven Spin-Orbit Torque MRAM Considering Thermal Coupling and BEOL Effects

Ya-Jui Tsou[1], Zong-You Luo[1], Chia-Che Chung[1], and C. W. Liu[1,2,]*

[1]Graduate Institute of Electronics Engineering, National Taiwan University, Taipei, Taiwan
[2]National Nano Device Laboratories, Hsinchu, Taiwan *cliu@ntu.edu.tw

24. Device size-dependent Spin-Orbit-Torque switching properties in a stepped MTJ with CMOS-compatible 8-inch fab processes

S. Z. Rahaman1,, I. J. Wang1, C. F. Pai2, J. H. Wei1, D. Y. Wang1, H. H. Lee1, Y. C. Hsin1, S. Y. Yang1, Y. J. Chang1, Y. C. Kuo1, Y. H. Su1, G. L. Chen1, H. Y. Lee1, K. C. Huang1, C. I. Wu1, and D. L. Deng1*

[1]Electronic and Optoelectronic System Research Laboratories, Industrial Technology Research Institute, Hsinchu, Taiwan
[2]Department of Materials Science and Engineering, National Taiwan University, Taipei, Taiwan
*E-mail: skzia@itri.org.tw

25. Spin-Orbit Torque Driven Multi-State Device for Memory Applications

S. Amara, U. Myrzakhan, A. Alsaui, M. Alawein and H. Fariborzi

CEMSE Division, King Abdullah University of Science and Technology (KAUST), Saudi Arabia

26. Field-Free Spin-Orbit Torque Switching of pMTJ Utilizing Voltage-Controlled Magnetic Anisotropy and STT

*Zong-You Luo1, Ya-Jui Tsou1, and C. W. Liu1,2,**

[1]Graduate Institute of Electronics Engineering, National Taiwan University, Taipei, Taiwan
[2]National Nano Device Laboratories, Hsinchu, Taiwan *cliu@ntu.edu.tw

27. Layout-aware optimization of an electric-field-controlled three-terminal pMTJ in the absence of external magnetic field

*Jiefang Deng1, 2, Xuanyao Fong1, Venkata Pavan Kumar Miriyala1, Panpan Zhang1, and Gengchiau Liang1, 2**

[1]Department of Electrical and Computer Engineering, National University of Singapore, Singapore 117583
[2]Centre for Advanced 2D Materials and Graphene Research Centre, National University of Singapore, Singapore 117546
*Email: elelg@nus.edu.sg

28. Fundamental Architectural Evaluation of Voltage Control Spintronics Memory (VoCSM) based Last Level Cache

Susumu Takeda [a)], Satoshi Takaya, Kazutaka Ikegami and Shinobu Fujita

Toshiba Corporation, Corporate R&D Center, Kawasaki, Kanagawa, Japan, [a)]email: susumu3.takeda@toshiba.co.jp

29. Ultra-Low Write Current and Strong Durability in New Spintronics Memories (spin-Hall MRAM and VoCSM) by Development of Novel Multilayer spin-Hall Electrode

Y. Kato, H. Yoda, M. Shimizu, T. Inokuchi, S. Oikawa, Y. Ohsawa, S. Shirotori, B. Altansargai, K. Koi, N. Shimomura, H. Sugiyama, and A. Kurobe

Corporate R&D Center, Toshiba Corporation, Kawasaki 212-8582, Japan

30. Three-terminal magnetic tunnel junctions for spintronic neural networks that capture biological neuron behavior

N. Hassan1, X. Hu1, L. Jiang-Wei1, W. H. Brigner1, O. G. Akinola2, F. Garcia-Sanchez3, M. Pasquale3, C.H. Bennett4, J. A. C. Incorvia2, and J. S. Friedman1

[1]UT Dallas ECE
[2]UT Austin ECE
[3]Istit. di Ricerca Metrologica
[4]Univ. Paris-Saclay

31. Bit Error Tolerance in MRAM-Based Binarized Neural Networks

T. Hirtzlin1, M. Bocquet2, N. Locatelli1, A. F. Vincent1, J.-O Klein1, J.-M Portal2 and D. Querlioz1

[1]C2N, CNRS, Univ Paris-Sud, Université Paris-Saclay, 91405 Orsay, France
Email: tifenn.hirtzlin@u-psud.fr, damien.querlioz@u-psud.fr
[2]Aix Marseille Univ, Université de Toulon, CNRS, IM2NP, Marseille, France

32. STT/MRAM Powered AI Accelerators for Edge-Intelligence Applications

Vivek Parmar, Abhishek Gupta and Manan Suri

CYRAN AI Solutions Pvt. Ltd., New Delhi, India
Department of Electrical Engineering, Indian Institute of Technology, Delhi, New Delhi, India