SATU Presidents' Forum
of Southeast and South Asia and Taiwan Universities
台灣與東南亞暨南亞大學校長論壇

National Cheng Kung University
No. 1, University Road,
701 Tainan City, Taiwan
: +886-6-2099250
: +886-6-2373551
: satu@email.ncku.edu.tw
: http://conf.ncku.edu.tw/satu

2016 SATU Joint Research Scheme Program

Host Application Form

Date: 22 / 4 / 2016 (year /month/day)

1. Host University

University of Malaya

2. Host Unit

Low Dimensional Materials Research Centre

3. Joint Research Project Title

Physical Properties and Skyrmion Phase in Manganese Silicide Nanowires Grown By HWCVD

4. Principal Investigator

Passport Name	Goh Boon Tong		
Nationality	Malaysia	Gender	√□M □F
Address	Department of Physics, University of Malaya, 50603 Kuala Lumpur, Malaysia		
Telephone	(Office) +603-79674147 / 2731 (Home / Mobile) +6016-6986308		
Fax Number	+603-79674146	E-mail	gohbt@um.edu.my

5. Co- PI from the same unit – If any

Passport Name	Zarina binti Aspanut		
Nationality	Malaysia	Gender	□M √□F
Address	Department of Physics, University of Malaya, 50603 Kuala Lumpur, Malaysia		
Telephone	(Office) +603-79674147 (Home / Mobile) +6017-2158764		
Fax Number	+603-79674146	E-mail	zarinaaspanut@um.edu.my

6. Project Details

Project Description (Executive Summary)	Metal silicide nanowires have been studied for a variety of technological applications including electronics, spintronics, thermoelectrics, and solar energy harvesting. Manganese silicides (MnSi), is among the narrow bandgap semiconductors, are particularly attractive for several applications as mentioned owing to

National Cheng Kung University
No. 1, University Road,
701 Tainan City, Taiwan
: +886-6-2099250
: +886-6-2373551
: satu@email.ncku.edu.tw
: http://conf.ncku.edu.tw/satu

their complex crystal structures and promising physical and chemical properties [1, 2]. Currently, MnSi nanowires are grown using the chemical vapour transport technique which requires high temperatures (above 900°C) and inorganic complexes precursors such as $Mn(CO)_5SiCl_3$ [3]. There is some difficulty in controlling the stoichiometry of such vapour transport growth nanowires due to the complexity of the phase formation. The inhomogeneous of compositions in MnSi could degrade the electrical and magnetic properties of the nanowires in device performances. As such, the proposed novel heat-induction by HWCVD provides a controllable Si precursor into the metallic Mn thin film to achieve a desired stoichiometry of MnSi nanowires. In addition, the heat-induction approach provides low temperatures (<500°C), high rate, and large areas of deposition [4]. Furthermore, magnetic skyrmions, known as tiny, swirling magnetic spin patterns, had been introduced as a new alternative in highly energy-efficient spintronic applications and magnetic storage media [5-11]. MnSi is one of a few exotic materials exhibiting the fascinating physical behaviour. With the help of HWCVD, we can study the growth mechanism of the MnSi nanowires and its influence of skyrmion phase. The objectives of the work are to investigate the inhomogeneity of the MnSi nanowires grown by HWCVD, and the controlled compositions on the electrical and magnetic behaviours of the MnSi nanowires. Last but not least, the growth mechanism of the MnSi nanowires grown by the HWCVD will be proposed. The low-temperature growth MnSi nanowires are expected to show a great potential in magnetic sensor, thermoelectric, field emission, optoelectronic and spintronic devices.

References

1. C. Pfleiderer, D. Reznik, L. Pintschovius, H. von Lohneysen, M. Garst and A. Rosch, Nature 427, 227–231 (2004).
2. C. Pfleiderer, S. R. Julian and G. G. Lonzarich, Nature 414, 427–430 (2001).
3. J. M. Higgins, A. L. Schmitt, I. A. Guzei and S. Jin, J. Am. Chem. Soc. 130, 16086–16094 (2008).
4. S. Klein, R. Carius, F. Finger, L. Houben, Thin Solid Films 501, 169 (2006).

National Cheng Kung University
No. 1, University Road,
701 Tainan City, Taiwan
: +886-6-2099250
: +886-6-2373551
: satu@email.ncku.edu.tw
: http://conf.ncku.edu.tw/satu

5. F. Jonietz et al. Science 330, 1648–1651 (2010).
6. T. Schulz et al. Nature Phys. 8, 301–304 (2012).
7. X. Z. Yu et al. Nature Commun. 3, 988 (2012).
8. J. Iwasaki, M. Mochizuki & N. Nagaosa, Nature Commun. 4, 1463 (2013).
9. A. Fert, V. Cros, & J. Sampaio, Nature Nanotech. 8, 152–156 (2013).
10. J. Iwasaki, M. Mochizuki & N. Nagaosa, Nature Nanotech. 8, 742–747 (2013).
11. J. Sampaio, V. Cros, S. Rohart, A. Thiaville & A. Fert, Nature Nanotech. 8, 839–844 (2013).

7. Acknowledgement (Signed by the President or SATU representative to show recognition)

Name
title

PROFESSOR DR. NOORSAADAH ABD. RAHMAN
Deputy Vice-Chancellor
(Research & Innovation)
University of Malaya
50603 Kuala Lumpur

_____ **(signature)**

Date: / 4 / 2016 **(yyyy/mm/dd)**

Please email satu@email.ncku.edu.tw before 2016.4. 29(Fri.) for application with the subject line: < 2016 SATU JRS host application –School Name>. Thank you.