






Editorial

Preface for the special issue on Microscopy of Semiconducting Materials 2019

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This issue contains selected invited and contributed presentations from the 21st international conference on ‘*Microscopy of Semiconducting Materials*’ held at Fitzwilliam College, University of Cambridge, on 9–12 April 2019. The meeting was organised by the Institute of Physics, supported by the Royal Microscopical Society, the European Microscopy Society, attolight (Platinum sponsor), JEOL (Gold sponsor) and ThermoFisher Scientific (Silver sponsor).

The conference series, inaugurated by Anthony (‘Tony’) G Cullis in 1979 and held biennially for now 40 years, deals with advances in semiconductor studies carried out by all forms of microscopy, with an emphasis on electron and scanning probe microscopy with high spatial resolution. This field has been flourishing for so long due to the need for materials and device characterisation at the atomic level to continuously explore new materials and concepts for electronic and optical applications, in line with the updated *International Technology Roadmap for Semiconductors* (ITRS 2.0).

As semiconductor devices shrink further new routes for device processing and characterisation need to be developed, and, for the latter, methods that offer sub-nanometre spatial resolution are particularly valuable. The various forms of imaging, diffraction and spectroscopy available in modern microscopes are powerful tools for studying the microstructure, electronic structure, chemistry and also electric fields in semiconducting materials. Advances in instrumentation during the past decade, from lens aberration correction in electron microscopes, to the development of a wide range of scanning probe techniques, as well as new methods of signal quantification have been presented at this conference.

This meeting was attended by 77 scientific delegates from 21 countries world-wide. We had 80 scientific contributions, including 14 invited talks, 35 contributed talks and 31 poster presentations. The statistical survey of past conferences shown in figure 4 demonstrates that the number of attendees and contributions seems to have stabilised at values just under 100 of which however only a small fraction tend to submit manuscripts for publication, so the future of such conference publications seems uncertain. Provided below are the references to proceedings and special issues from MSM conferences hosted since 2009 which are all available online.

This special issue contains the manuscripts of four invited talks given by Carol Trager-Cowan, Paola Favia, Crispin JD Hetherington and Ichiro Yonenaga, as well as nine contributed presentations. All manuscripts are listed in the reference section in chronological order as they have been published in different volumes and print issues as soon as they had been accepted, either in late 2019 or early 2020.



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Figure 1. The front of the conference building, with about half of the attendees.



Figure 2. The college dining hall in the afternoon.

All submissions have undergone a full peer review process by at least two independent reviewers.

Joanna Moneta (Warsaw, Poland) and Maximilian Widemann (Marburg, Germany) were awarded prizes for the high quality of their posters. Their presentations covered a broad range of microscopy techniques and materials issues and documented the excellent standard of microscopy being achieved by younger scientists.

The organisers are, as ever, very grateful to the following companies who contributed to the success of the meeting by presenting trade stands (in alphabetical order): attolight, Bruker, cnTech, Cameca, Hitachi, Mi-Net and Protochips.

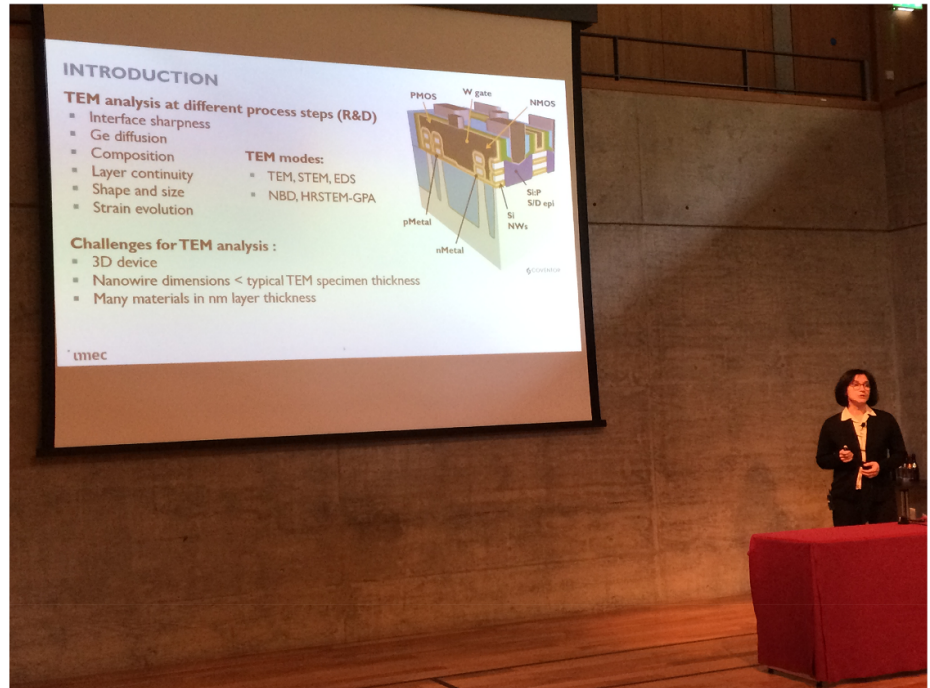


Figure 3. Dr Favia from Imec giving her invited talk.

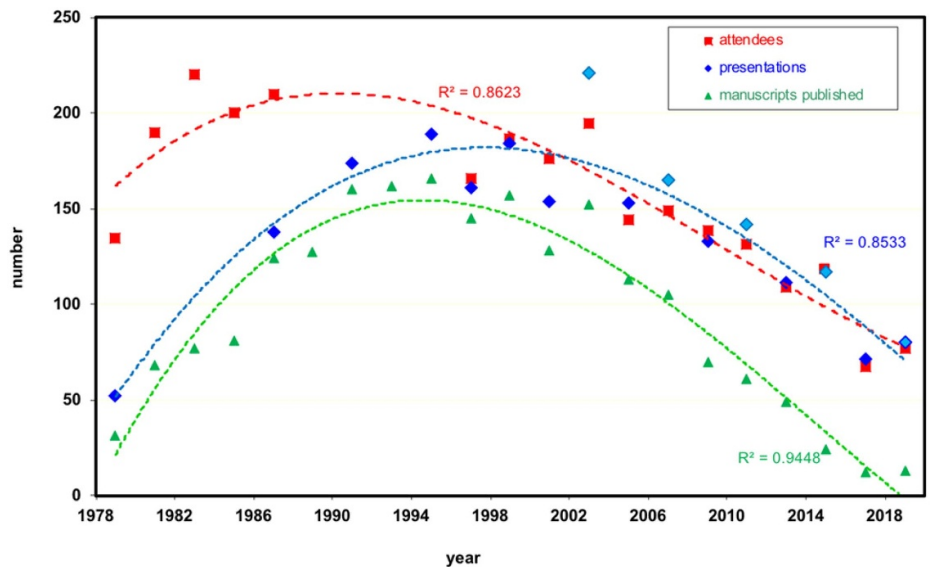


Figure 4. Statistics of all MSM conferences since their start in 1979.

Fitzwilliam College is thanked for provision of accommodation, very nice lecture facilities including helpful technical support, and the friendly catering staff who served us during the days.



We would like to also thank the staff of the Institute of Physics for their expert assistance in planning and supporting this meeting—in particular Claire Garland for her dedicated professional support and always joyful and helpful approach to any issues.

Finally, we are grateful to Ania Wronski and the Editorial staff of *Semiconductor Science and Technology* at IoP Publishing, as well as to all contributors and reviewers for helping us to put together this special issue.

This preface has been written up during the ongoing spread of the coronavirus infection by SARS-CoV-2 (COVID-2019), which has now brought all international conferences to a standstill and closed most universities. For those colleagues interested in previous conference proceedings, or who just want to inform themselves about recent trends in the field, please see the below list of prefaces from MSM conferences published within the last decade, appended to the reference section in chronological order.

Sheffield, May 2020.

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References

- [1] Bender H, Bosch E G T, Richard O, Mendez D, Favia P and Lazic I 2019 3D characterization of nanowire devices with STEM based methods *Semicond. Sci. Technol.* **34** 114001
- [2] Bender H, Richard O, Kundu P, Favia P, Zhong Z, Palenstijn W J, Batenburg K J, Wirix M, Kohr H and Schoenmakers R 2019 Combined STEM-EDS tomography of nanowire structures *Semicond. Sci. Technol.* **34** 114002
- [3] Favia P *et al* 2019 TEM investigations of gate-all-around nanowire devices *Semicond. Sci. Technol.* **34** 114003
- [4] Jenichen B, Cheng Z, Hanke M J, Herfort A and Trampert A 2019 Lattice matched volmer-weber growth of Fe₃Si on GaAs(001) – the influence of the growth rate *Semicond. Sci. Technol.* **34** 124002
- [5] Terker M, Jenichen B, Herfort J and Trampert A 2019 *In situ* transmission electron microscopy of solid phase epitaxy of Ge on Fe₃Si *Semicond. Sci. Technol.* **34** 124004
- [6] Yu Pereyaslavtsev A and Naumkin A V 2019 Ion-induced Auger electrons contrast on cross-beam systems *Semicond. Sci. Technol.* **34** 124005
- [7] Jin X, Schneider R, Popescu R, Hariskos D, Witte W M, Powalla and D Gerthsen 2020 Characterization of solution-grown and sputtered In_x(O,S)_y buffer layers in Cu(In,Ga)Se₂ solar cells by analytical TEM *Semicond. Sci. Technol.* **35** 034001
- [8] Prabhakara V, Jannis D, Béché A, Bender H and Verbeeck J 2020 Strain measurement in semiconductor FinFET devices using a novel moiré demodulation technique *Semicond. Sci. Technol.* **35** 034002
- [9] Moneta J, Grzanka E, Turski H, Skierbiszewski C and Smalcz-Koziorowska J 2020 Stacking faults in plastically relaxed InGaN epilayers *Semicond. Sci. Technol.* **35** 034003
- [10] Hetherington C, Jacobsson D, Dick K A and Wallenberg L R 2020 *In situ* metal-organic chemical vapour deposition growth of III-V semiconductor nanowires in the Lund environmental transmission electron microscope *Semicond. Sci. Technol.* **35** 034004
- [11] Yonenaga I 2020 Atomic structures and dynamic properties of dislocations in semiconductors: current progress and stagnation *Semicond. Sci. Technol.* **35** 043001
- [12] Trager-Cowan C *et al* 2020 Structural and luminescence imaging and characterisation of semiconductors in the scanning electron microscope *Semicond. Sci. Technol.* **35** 054001
- [13] Walther T, Nutter J, Reithmaier J P and Pavelescu E-M 2020 X-ray mapping in a scanning transmission electron microscope of InGaAs quantum dots with embedded fractional monolayers of aluminium *Semicond. Sci. Technol.* **35** 084001
- [15] Walther T, Nellist P D, Hutchison J L and Cullis A G 2010 16th international conference on microscopy of semiconducting materials 2009 *J. Phys. Conf. Ser.* **209** 011001
- [16] Walther T and Midgley P A 2011 17th international conference on microscopy of semiconducting materials 2011 *J. Phys. Conf. Ser.* **326** 011001
- [17] Walther T and Hutchison J L 2013 18th microscopy of semiconducting materials conference (MSM XVIII) 2013 *J. Phys. Conf. Ser.* **471** 011001
- [18] Walther T and Sanchez A M 2015 Preface microscopy of semiconducting materials 2015, part 1 *Semicond. Sci. Technol.* **30** 110301
- [19] Walther T and Beanland R 2016 Preface of 19th microscopy of semiconducting materials conference, part 2 *J. Microsc.* **262** 131–3
- [20] Walther T and Jones L 2017 Preface to special issue on microscopy of semiconducting materials 2017 (MSM-XX) *J. Microsc.* **268** 221–4