Engineering and Physical Sciences Research Council

CS HUB NEWSLETTER

Welcome to this October 2022 CS Hub newsletter. Having promised a newsletter every 6 months following COVID we have slipped a bit but better late than never and there is now a huge amount to catch up on. We have recently had one of our most successful SIOE conferences and have also seen a number of exciting scientific breakthroughs. These include dramatically improved threshold current and high temperature operation for 1300nm emitting quantum dot (QD) lasers using n-type dopants placed directly in the QDs and p-type dopant adjacent to the QDs to provide sufficient holes, QD lasers emitting at 1550nm and red emitting LEDs fabricated from GaN nanowires, throwing open the possibility of full colour displays all on a GaN platform. Our recent progress on characterisation systems based on magnetic field sensors are in a separate article.
On September 15th we held an Industry day event, where latest ideas were presented, we listened to industry requirements and linked with academic and industry partners for new projects. The industry day also offered the opportunity for visitors to see the new Translational Research Hub facilities in Cardiff including 1350m2 of cleanroom space and additional material and device characterisation facilities.

The TRH building is handed over to Cardiff University

1st July 2022 saw the official hand over of the Translational Research Hub (TRH). The hub is now home to two leading research establishments – the Institute for Compound Semiconductors (ICS) and Cardiff Catalysis Institute (CCI).
https://www.cardiff.ac.uk/news/view/2631361-magnet-for-innovation-opens-for-business

Delivery of the new equipment has already begun and this will continue over the next few months.
https://twitter.com/ICSCU/status/1542068157573120002

SIOE Conference 2022 Success – April 22

SIOE 2022
Semiconductor & Integrated Opto-electronics conference

The 35th SIOE conference, held predominately at Cardiff University's new Centre for Student Life successfully brought an exciting programme where over 120 delegates enjoyed a wide range of topics from 62 presentations. The topics covered a range of expertise, including: Materials Development and the impact of materials innovations on devices; Components for Integration / Integration Platforms; VCSELs and Growth.

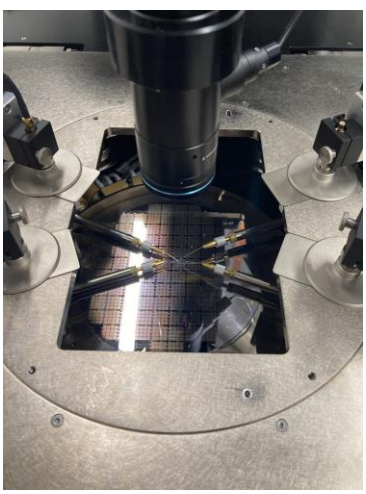
The University Of Sheffield. | MANCHESTER 1824 The University of Manchester | UCL | CARDIFF UNIVERSITY PRIFYSGOL CAERDYDD

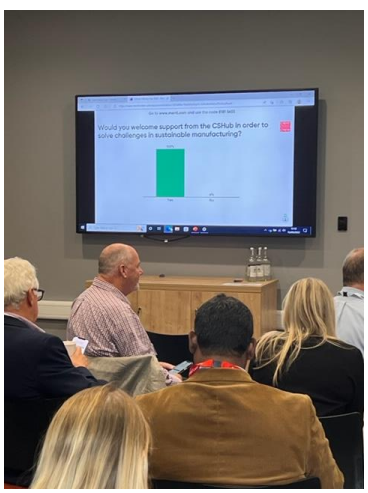
Industry Day

The CS Hub Industry event took place in September at the new Translational Research Hub (TRH) building in Cardiff. The event showcased the cutting-edge facilities at the TRH and the world leading research that the CS Hub undertakes, with delegates given guided tours of the new building With over 20 companies represented, delegates listened to talks and discussions from the CS Hub and partner companies and gained an insight into current research with plenty of opportunity to network.

Read our 2022 Annual Report

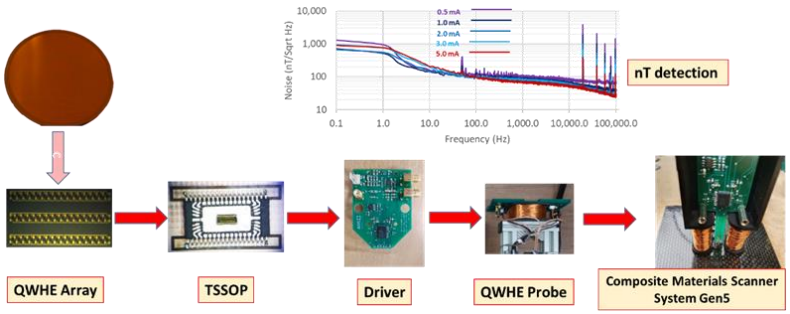
CS Hub Annual Report 2022 – The Future Compound Semiconductor Manufacturing Hub (compoundsemiconductorhub.org)





In Focus: Work Package 7

"Our recent developments in 2DEG-based Quantum Well Hall Effect (QWHE) sensors have led to the development of unique magnetic imaging systems for Non-Destructive Testing (NDT) applications and have generated interests for potential applications in a wide range of industries. These interests arise mainly from the compound semiconductor sensors' versatility, inherently ultra-high sensitivity of the 2DEG Hall sensors, the large bandwidth (DC to 4MHz) and high linearity coupled with the ability to integrate them into linear sensor arrays with micron scale pitch."



Integrated system manufacturing (from chips to systems)

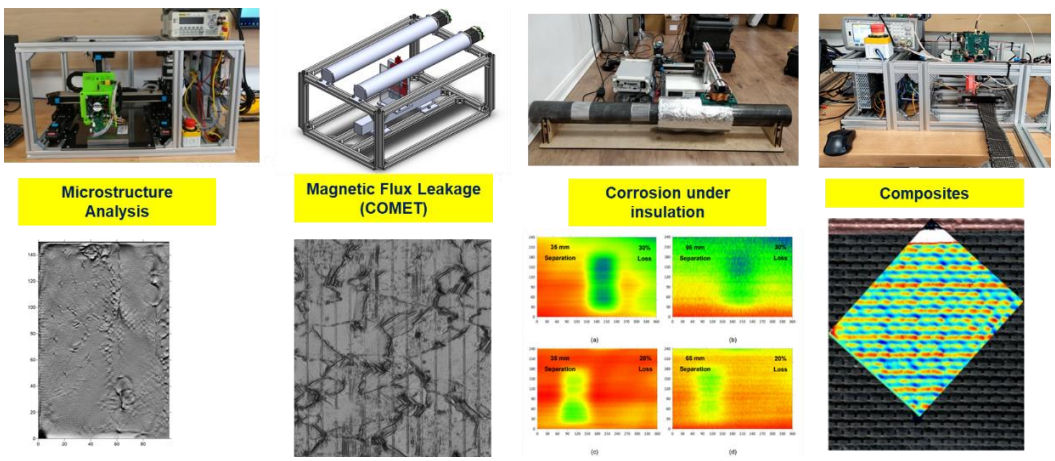
Stay in Touch

All our latest news is available on our website: compoundsemiconductorhub.org

Follow us on Twitter: @FutureCSHub

Research Summary

To date, these 2DEG Hall sensors have been used to explore the characterisation of materials based on their frequency-dependent magnetic properties, as well as detect surface-breaking discontinuities in manufactured components, including carbon steel welds and composites. With the potential to design more sophisticated on-chip instrumentation amplifiers, superheterodyne current sources, filters and other circuitry, these 2DEG devices are leading the way in terms of bespoke fabrication for specific industrial applications such surface-breaking flaws in welds. Successful development of QWHE sensor linear arrays with a fine pitch has been achieved and used in detecting surface-breaking flaws, magnetic domain imaging and microstructure analysis as well as grain imaging in electrical steel. During the project numerous scanning systems have been developed spanning the application range from Corrosion under Insulation (50Hz) to imaging of defects in composites (4MHz).



Continued

In Focus: Work Package 7

Progress and challenges to date

The key challenges, when dealing with fast decaying magnetic fields with distance, are the need for Increased sensitivity and lower noise for enhanced imaging and real time imaging (< 1 min for very high resolution 10x10 cm steel and composites plates).

These challenges are being addressed using Novel packaging and new field concentrators techniques, Higher magnetic sensitivity materials (InGaAs-InAlAs on GaAs) at the materials level and the use of multi-channel ADC data acquisition and parallel processing to speed imaging of large structures.

The research has demonstrated imaging from 50Hz to 1MHz comprising ferrous, non-ferrous and composite materials using compact 2DEG magnetic sensor arrays.

Furthermore, a novel technique we denote as QW-ECFM (QW-Eddy Current Field Measurements) has been developed which gives high resolution magnetic images in composites for the first time (see paper 1 in the publication spotlight list).

This work has demonstrated unique new magnetic imaging modalities using the highly sensitive 2DEG arrays developed in WP7.

Lead: Prof M. Missous

Inspiring the Next Generation

CSHub is thrilled to be supporting Science made Simple and Cardiff University, School of Physics and Astronomy on project Generation Tech. The project aimed at 9-12 year olds will see individuals working within the industry deliver school workshops on our everyday use of technology.

Publication Spotlight

1) A new high-frequency eddy current technique for detection and imaging of flaws in carbon fibre-reinforced polymer materials, Watson, J M; Liang, C W; Sexton, J and Missous, M Insight - Non-Destructive Testing and Condition Monitoring, Volume 63, Number 9, September 2021, pp. 525-528(4)

2) Magnetic field frequency optimisation for MFL imaging using QWHE sensors, Watson, J M; Liang, C W; Sexton, J; Missous, M Insight - Non-Destructive Testing and Condition Monitoring, Volume 62, Number 7, July 2020, pp. 396-401(6)

3) Development and optimisation of low-power magnetic flux leakage inspection parameters for mild steel welds, Watson, J M; Liang, C W; Sexton, J; Missous, M Insight - Non-Destructive Testing and Condition Monitoring, Volume 63, Number 2, February 2021, pp. 75-81(7)

4) Optimising sensor pitch for magnetic flux leakage imaging systems Murshudov, R; Watson, J M; Liang, C W; Sexton, J; Missous, M Insight - Non-Destructive Testing and Condition Monitoring, Volume 63, Number 7, July 2021, pp. 416-421(6)

5) Dr Sam Shutts - published in CS Magazine (Volume 28 Issue 5, page 44) describing a simplified stripped backed process that could fabricate a VCSEL for testing purposes within 24 hours. Welcome to - News, features and analysis. (compoundsemiconductor.net)