

New research helps to make the most of nanoscale effects for nanotechnology

Research at Swansea University is helping to meet the challenge of using nanoscale structures in future semiconductor devices and impact on everyday life.

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/EINPresswire.com/ -- Research by scientists at Swansea University is helping to meet the challenge of

incorporating nanoscale structures into future semiconductor devices that will create new technologies and impact on all aspects of everyday life.

Dr Alex Lord and Professor Steve Wilks from the Centre for Nanohealth led the collaborative research published in Nano Letters. The research team looked at ways to engineer electrical contact

technology on minute scales with simple and effective modifications to nanowires that can be used to develop enhanced devices based on the nanomaterials. Well-defined electrical contacts are essential for any electrical circuit and electronic device because they control the flow of electricity that is fundamental to the operational capability.

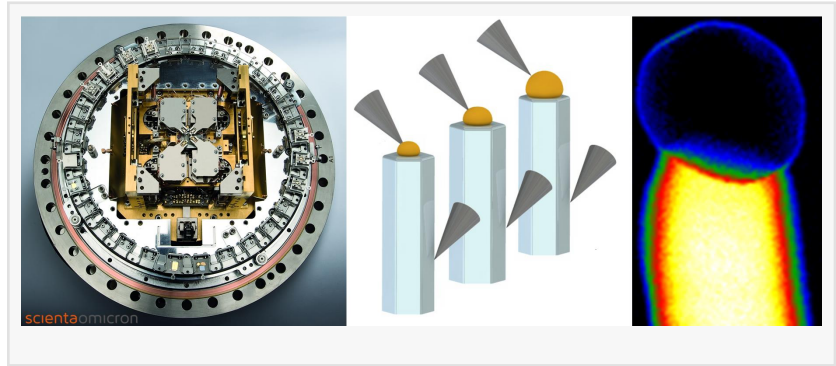
Everyday materials that are being scaled down to the size of nanometres (one million times smaller than a millimetre on a standard ruler) by scientists on a global scale are seen as the

future of electronic devices. The scientific and engineering advances are leading to new technologies such as energy producing clothing to power our personal gadgets and sensors to monitor our health and the surrounding environment.

Over the coming years this will make a massive contribution to the explosion that is the Internet of Things connecting everything from our homes to our cars into a web of communication. All of these new technologies require similar advances in electrical circuits and especially electrical contacts that allow the devices to work correctly with electricity.

Professor Steve Wilks said: "Nanotechnology has delivered new materials and new technologies and the applications of nanotechnology will continue to expand over the coming decades with much of its usefulness stemming from effects that occur at the atomic- or nano-scale. With the advent of nanotechnology, new technologies have emerged such as chemical and biological sensors, quantum computing, energy harvesting, lasers, and environmental and photon-detectors, but there is a pressing need to develop new electrical contact preparation techniques to ensure these devices become an everyday reality."

"Traditional methods of engineering electrical contacts have been applied to nanomaterials but often neglect the nanoscale effects that nanoscientists have worked so hard to uncover. Currently, there isn't a design toolbox to make electrical contacts of chosen properties to nanomaterials and in some



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The advances that nanotechnology is making will undoubtedly change modern life forever”

Alex Lord

respects the research is lagging behind our potential application of the enhanced materials.”
The Swansea research team used specialist experimental equipment and collaborated with Professor Quentin Ramasse of the SuperSTEM Laboratory, Science and Facilities Technology Council [[Nano Letters #1](#)]. The scientists were able to physically interact with the nanostructures and measure how the nanoscale modifications affected the electrical performance. [[Nano Letters #2](#)]
Their experiments found for the first time, that simple changes to the catalyst edge can turn-on or turn-off the dominant electrical conduction and most importantly reveal a powerful technique that will allow nanoengineers to select the properties of manufacturable nanowire devices.
Dr Lord said: “The experiments had a simple premise but were challenging to optimise and allow atomic-scale imaging of the interfaces. However, it was essential to this study and will allow many more materials to be investigated in a similar way.”

“This research now gives us an understanding of these new effects and will allow engineers in the future to reliably produce electrical contacts to these nanomaterials which is essential for the materials to be used in the technologies of tomorrow.

“In the near future this work can help enhance current nanotechnology devices such as biosensors and also lead to new technologies such as Transient Electronics that are devices that diminish and vanish without a trace which is an essential property when they are applied as diagnostic tools inside the human body.”

References

1. Lord, A. M., Ramasse, Q. M., Kepaptsoglou, D. M., Evans, J. E., Davies, P. R., Ward, M. B. & Wilks, S. P. 2016 Modifying the Interface Edge to Control the Electrical Transport Properties of Nanocontacts to Nanowires. *Nano Lett.* (doi:10.1021/acs.nanolett.6b03699).

<http://pubs.acs.org/doi/abs/10.1021/acs.nanolett.6b03699>

2. Lord, A. M. et al. 2015 Controlling the electrical transport properties of nanocontacts to nanowires. *Nano Lett.* 15, 4248–4254. (doi:10.1021/nl503743t) <http://pubs.acs.org/doi/abs/10.1021/nl503743t>

Notes to editors:

Swansea University is a world-class, research-led, dual campus university. The University was established in 1920 and was the first campus university in the UK. It currently offers around 350 undergraduate courses and 350 postgraduate courses to circa 20,000 undergraduate and postgraduate students.

The University's 46-acre Singleton Park Campus is located in beautiful parkland with views across Swansea Bay. The University's 65-acre science and innovation Bay Campus, which opened in September 2015, is located a few miles away on the eastern approach to the city. It has the distinction of having direct access to a beach and its own seafront promenade. Both campuses are close to the Gower Peninsula, the UK's first Area of Outstanding Natural Beauty.

Swansea is ranked the top university in Wales and is currently The Times and The Sunday Times 'Welsh University of the Year'. It is also ranked within the top 350 best universities in the world in the Times Higher Education World University rankings.

The results of the Research Excellence Framework (REF) 2014 showed the University has achieved its ambition to be a top 30 research University, soaring up the league table to 26th in the UK, with the 'biggest leap among research-intensive institutions' (Times Higher Education, December 2014) in the UK.

The University has ambitious expansion plans as it moves towards its centenary in 2020, as it continues to extend its global reach and realising its domestic and international ambitions.

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For more information, please contact Delyth Purchase Swansea University Public Relations Office. Tel: 01792 513022, or email: 01792 513022.

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Alex Lord
Swansea University
+44 (0)1792606007
email us here

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