Developing Nanosensors for Health Monitoring

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Mahnaz Shafiei et al. have exploited nanofibers to develop sensors that can monitor patients' health. Several Australian and Japanese companies support this study.

Dr Mahnaz Shafiei's research focus is on sensors and nanomaterials and their practical use for health and environmental monitoring. Dr Shafiei is a Swinburne Vice-Chancellor's Research Fellow – Women in STEM. These fellowships have been designed to address the critical underrepresentation of women in science, technology, engineering and maths research and teaching.

Having undertaken a Bachelor of Science in Electrical and Electronics Engineering at AmirKabir University of Technology (AUT) in Iran, Dr Shafiei completed a PhD at RMIT University in 2011, followed by postdoctoral research at Queensland University of Technology (QUT) and an Australian Endeavour Research Fellowship at Simon Fraser University, Canada.

She joined Swinburne in 2017, where she enjoys the support of a curious and collaborative team and many opportunities to engage with industry to further her research.

Sensor lab

With funding support from the university's Faculty of Science, Engineering and Technology and the Australian Renewable Energy Agency (ARENA), Dr Shafiei has established a world-class sensor laboratory at Swinburne. "Nanoscience, nanotechnology and sensing are powerful technologies that enable the development of integrated and portable sensor devices," she says.

Together with collaborative networks at ANU and RMIT, she is investigating non-invasive medical diagnostics by breath analysis, thanks to an Australian Research Council Discovery Project. "In our research, we are developing reliable, portable and inexpensive sensors to

monitor important biomarkers in our breath that could enable early disease diagnosis and management," she says. "For example, in diabetics we can measure the concentration of acetone, a specific volatile organic compound (VOC) that is the biomarker for Type 1 diabetes. A high acetone reading is a warning sign that your diabetes isn't under control."

In 2017, Dr Shafiei and her Swinburne colleagues with their industry partner were awarded a grant from the Department of Industry, Innovation and Science to develop a hydrocarbon liquid sensing system to be integrated into the IoT platform for continuous real-time environmental monitoring. The developed system has a potential use in the oil industry where leakage and spillage could contaminate soil and ground water.

International collaborations

International collaborations are an important part of sensor research and Dr Shafiei has developed strong links with other laboratories in Italy, Japan, Canada and Hong Kong. With grant support from Swinburne's School of Software and Electrical Engineering, she is collaborating with leaders in the field of nano-sensing at the International Center for Materials Nanoarchitectonics and the National Institute for Materials Science (NIMS) in Japan.

This work aims to integrate nanofibres developed by her PhD student with novel sensing platforms developed by the NIMS group for VOCs and humidity sensing. More recently, Dr Shafiei's group has added a research project that aims to develop low-power, portable sensing systems to monitor hydrogen gas and VOCs as part of an ARENA project to produce hydrogen from renewable energy.

"The project will establish a pilot plant to test a range of new technologies in hydrogen production," Dr Shafiei says. As well as Swinburne, the project involves QUT, Griffith University and the University of Tokyo, along with industry partners Sumitomo Electric industries (Japan) and Energy Developments Limited (Australia). This year Dr Shafiei and colleagues also established a new international collaboration with researchers at UNICAMP on "Two-dimensional nanomaterials for gas sensing applications", thanks to SPRINT – Swinburne and FAPESP Priority Partnership Fund.

Swinburne and gender equity

Swinburne has received a Bronze Award, the highest recognition available in Australia, for its Athena SWAN Action Plan 2019-2022 to improve the attraction, promotion and retention of women and gender minorities in STEMM.

The university has long been a champion of gender equity and for the past ten consecutive years has been recognised by the Workplace Gender Equality Agency (WGEA) as an Employer of Choice for Women.

A Vice-Chancellor's Research Fellow – Women in STEM (Civil and/or Mechanical Engineering) is currently open to suitably qualified women candidates. Applications close at 5pm on 21 June 2019.

Read the original article on Swinburne University.