New materials open door to electronics in extreme environments

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A spin-out company from the University of Leeds is set to transform industry's ability to electronically monitor and interact with extreme environments.

Ionix Advanced Technologies Ltd, incorporated in October 2011 by University of Leeds researchers, announced this month that it had received funding from IP Group plc. to accelerate the commercialisation of a range of devices based on high-temperature piezoelectric materials developed by the University.

Piezoelectric technology is already a part of our daily lives. It provides the critical link that converts physical forces in an environment into electricity (and vice versa) and is used in everything from SONAR to industrial sensors to ultrasound scans in pregnancy.

However, it has not previously been possible to expose piezoelectric devices to extremes such as high temperatures and pressures. The new materials developed at the University break down that barrier. The potential market in industries such as aerospace, oil and gas and nuclear power, estimated at more than £500 million per annum.

Professor Andrew Bell, from the University's School of Process, Environmental and Materials Engineering (SPEME), headed the research: "Our materials work in environments where the conventional technology fails: high temperatures, high pressures, extreme shocks and high stress. In a gas turbine, for instance, if you want to put in a sensor to

make sure nothing is going wrong, you need a piezoelectric material that can withstand extremely high temperatures, pressures or vibrations."

The new materials, developed by Dr Tim Comyn and Dr Tim Stevenson in Professor Bell's group, are compatible with existing manufacturing methods for piezoelectric ceramics and therefore can be mass-produced at similar cost to current materials.

The fundamental science is the same: physical changes to the piezoelectric material's crystal lattice create an electrical change or, conversely, create physical changes when an electrical current is applied. However, the new ceramics include novel ingredients such as bismuth and iron and have a greatly increased tolerance.

Ionix is initially targeting applications where high temperature operation, up to 500 degrees centigrade, provides capabilities not offered by conventional devices.

The company has also announced the appointment of Dr David Astles as its Chief Executive Officer. Dr Astles has extensive leadership experience with the multi-national oil and gas company Shell and small company start-ups. He has a track-record of launching new products and technology in a wide range of industry sectors including chemical processing, oil and gas, lubricants, mining and refining.

Dr Astles said: "Ionix has developed a set of excellent products which offer a range of exciting potential opportunities. I look forward to working closely with the talented Ionix team to lead the company in the next stage of its commercial development. We are at the start of an exciting new phase in the implementation of this technology and are looking for the right partners to realise its potential."

The research at Leeds was partly funded by two grants and a PhD

studentship from the Engineering and Physical Sciences Research Council (EPSRC).

Mark Claydon-Smith, the EPSRC's Manufacturing the Future Manager said: "The government has highlighted the opportunities in advanced materials, which is one of its "8 great technologies" and was also referenced in the recent Foresight report. This project is an excellent example of commercialisation of advanced functional materials for use in high performance engineering applications."

Provided by University of Leeds