Automotive safety systems will contain many more MEMS chips in the coming years, and a considerable number could be embedded in fabrics.

**AUTOMOTIVE** safety systems are to be found in a growing number of vehicles, and shipments of MEMS — micro-electro-mechanical systems — that are crucial to their operation, are increasing even faster.

Presently, a European Union FP7 project is exploring the fabrication of miniature sensors and actuators (transducers) based on MEMS for the production of flexible smart fabrics, based on screen and inkjet printing, which could open up a range of new applications in automotive interior fabrics.

**Rocketing**

Nearly 100 million airbag, tyre pressure monitoring, and electronic stability (ESP) safety systems containing more than 300 million MEMS chips were sold worldwide during 2010.

By 2016, about 150 million systems are expected to be installed in vehicles, but the number of MEMS they contain will have rocketed to over 830 million.

"Safety systems are becoming more advanced and more complex, and each new system tends to contain more sensors than previous generations," explains ABI Research practice director Peter Cooney. MEMS generally fall into three main categories — accelerometers, pressure sensors, and gyroscopes.

One technical trend is to integrate several sensors, or types of sensor, on a single chip, and a related trend is to make a single MEMS do double or triple duty in the service of several safety systems.

"Sensor integration will have a negative effect on MEMS sensor market growth, which will also come under pressure from increasing market competition," says Cooney, who is the author of a new ABI report, "Automotive MEMS Sensors:"

More important than any of these changes, however, is the single largest driver of the automotive MEMS and safety systems market. Governments make safety systems mandatory, MEMS suppliers see a big benefit.

MEMS suppliers to the automotive market are few and it's certainly no market for start-ups being both difficult to get into and requiring substantial financing. But profits can be significant for those who succeed.

**Printing MEMS on fabrics**

MEMS processing capability for the production of flexible smart fabrics based on screen and inkjet printing — with new functional inks compatible with fabrics — is the goal of the £7.2 million EU FP7 MicroFlex project.

The four-year project involves 14 partners from nine countries — including textile companies Klopman International, Bonfort, Paul Boye — and will announce its final results in October 2012.

The MicroFlex project is concentrating on fabricating miniature sensors and actuators (transducers) based on MEMS which have mechanical and electrical functionality.

"At present MEMS technology is dominated by silicon microfabrication technology, although polymer materials and processes are increasingly being used," explains Dr Steve
Avoiding hot spots

CoTexx knitted heating fabric developed by the company of the same name based in Gachenbach, Germany, is a semi-finished fabric made of litz wire. It is being used for the simple and cost-effective construction of electric panel heaters which can be effectively employed in automotive interiors.

It also has the potential for use in composite parts manufacturing. Embedded in heated female moulds or heated silicon hoods the product helps not only to drastically reduce cycle times, but also to reduce the viscosity of the resin during injection, by preheating the mould.

"Studies conducted recently have confirmed that due to the reasonably large specific surface of the litz wire used, the thermal transfer to the surrounding matrix is extremely effective and therefore without unwanted thermal peaks," explained CoTexx managing director Hans-Thilo Langer.

CoTexx consists of a knitted fabric made of multiple strands of litz wires. The individual wires of the litz wires are enamelled and insulated against each other, so in the case of breakage of individual wires, 'hot spots' are impossible.

Up to now, a maximum heating power of up to 1,500 watts per square metre has been demonstrated with a maximum temperature of 140°C. In specially designed models, temperatures of more than 240°C and much higher heating capacity can be achieved, the company says.

In addition to automotive and moulds for the manufacturing of fibre-reinforced plastics, other end-uses include use in electric airfoil ice protection systems for wings, rotor blades and propellers and the electric heating of tubing and lines for aircraft. It can also be used as a de-icer in a range of household and construction applications.

CoTexx is distinguished by a homogeneous heat distribution and a technically reliable design, making it simple and easy to process. Contacting is rapid and reliable and it can operate with extra low voltage as well as rotating current.

The global engineering group Meggitt has developed a screen printable piezoelectric paste, based on graphite, that can be printed onto fabrics.


An electro-luminescent lamp has been screen-printed on fabric.
All of these developments are currently being evaluated.

www.abiresearch.com/research/006492
www.microtex.de/soton.ac.uk