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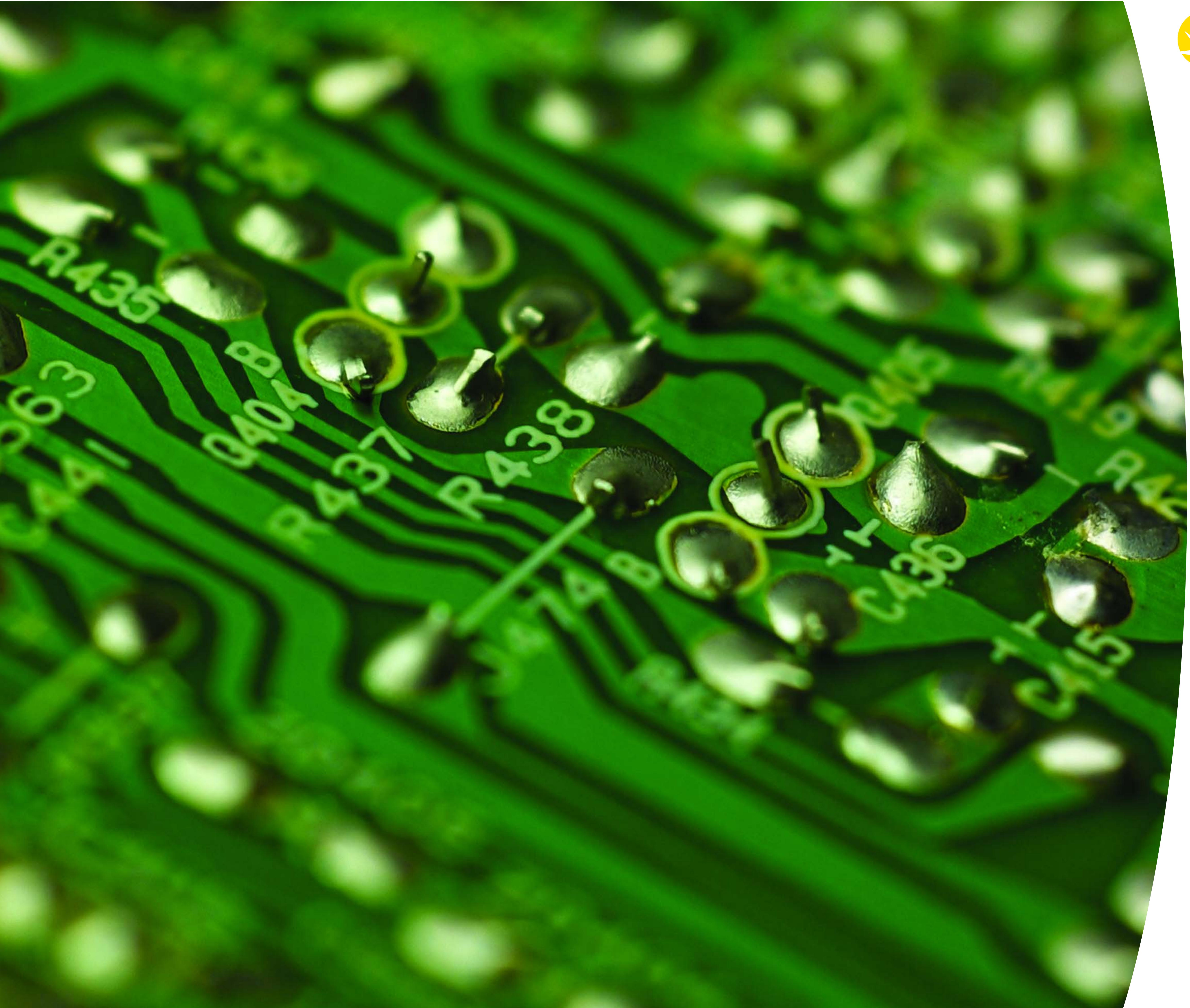
Light for Science




# Electronics

# overview

**The electronics and electrical sectors continually strive to develop and launch new high technology products that advance society and make people's lives easier and more fulfilling.**

**Synchrotrons offer a range of research techniques that will enable electronics and electrical companies to exploit fully the new and emerging technologies of the 21st century.**

**By exploring the potentials of the synchrotron in areas such as nanoscience, materials and magnetism, this sector will tap into a source of new materials and discoveries that will overcome many existing limits on the performance of industrial materials.**

### Key Challenges

- **Uncovering new materials**
  Manufacturing and probing materials at the nanometre length scale will address questions, such as behaviour in reduced dimensions, which current lab techniques such as scanning microscopy are unable to answer.

- **Designing and characterising advanced materials**
  Semiconductors and nanostructures are at the forefront of science and technology. The X-rays that synchrotrons generate offer an 'enabling technology' and the key to the design and characterisation of materials that will bring about major developments in the electronics and electrical sectors.

### The Synchrotron Solution

**Techniques**
One key area for this sector is nanoscience, where X-ray photoelectron emission microscopy (PEEM) can significantly advance the understanding of the formation, composition, structure and properties of nanostructures.

In addition, Diamond's materials diffraction beamline I16 will provide a unique, world-class X-ray diffraction facility for studying diverse materials with unprecedented resolution and sensitivity.

Grazing incidence X-ray diffraction can be used to monitor in situ growth to optimise production conditions, while sub-micron
X-ray Absorption Spectroscopy will allow the study of complex inhomogenous materials under realistic conditions.

**Beamlines:** I06 Nanoscience, I16 Materials & Magnetism, I07 Surface & Interface Diffraction, I18 Microfocus Spectroscopy

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# case studies

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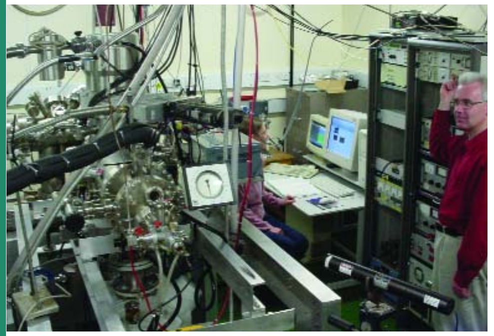
### High moment films for magnetic recording

There is much excitement surrounding the technological developments that could result from research and development at the nanoscale.

Scientists at the University of Leicester have been working on the properties of magnetic nanoparticles and, in the last 4 years, their work has caught the attention of electronics companies such as Seagate.

Prof Chris Binns explains, "We are now able to create magnetic nanoparticles that are a few hundred atoms in size. Using the European Synchrotron Radiation Source (ESRF) in France, we have been able to identify enhanced magnetic moments and develop a recipe for high moment films, which is an exciting breakthrough."



Seagate see the commercial potential of using high moment materials for magnetic recording as it will deliver yet higher data recording densities.

Prof Binns adds, "At present the flux of particles we are working with is too small to be of use commercially so the current challenge is to scale up the process and make it possible to produce high moment films in viable quantities."

Source: Prof Chris Binns cb12@leicester.ac.uk

### Polymer ordering in flat-panel displays

In electronics, understanding how a structure's surface differs from its bulk can lead to major advances in product development.

To understand the structure of very thin films, such as those used to control the alignment of liquid crystals in flat-panel displays, a technique called grazing-incidence X-ray scattering (GIXS) can be used. This technique provides direct information on the near surface structure and its alignment affect on the liquid crystalline molecules.

Research carried out by scientists at the University of Cardiff is directed at probing the structural order in semiconductor polymer films at the buried interface with the gate insulator in organic transistors. The molecular interactions in liquid crystalline polymers can be exploited to provide a degree of control over the structural ordering. The structure of the surface, bulk and buried interface can now be proved during in-situ processing, giving unsurpassed structural characterisation of polymeric thin films.

Improved order at the semiconductor-gate interface would lead to improved performance of organic devices.

Improved order in this narrow interfacial region would lead to improved performance of organic devices.

Source: Dr Emyr Macdonald
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