

# Knowledge Transfer Partnerships

## KTP BENEFITS

Knowledge Transfer Partnerships are designed to benefit everyone involved

- Businesses will acquire new knowledge and expertise
- KTP Associates will gain business-based experience and personal and professional development opportunities
- Universities, colleges or research organisations will bring their experience to enhance the business relevance of their research and teaching

Knowledge Transfer Partnerships Accelerating business innovation; a Technology Strategy Board programme  
<http://www.ktponline.org.uk>

# TORR SCIENTIFIC LIMITED

## KTP HAS INSPIRED THE COMPANY TO SEEK SCIENTIFIC BASED SOLUTIONS TO CHALLENGES

### ABOUT THIS CASE STUDY

Torr Scientific Limited collaborated with the University of Surrey on this KTP to enhance its production processes by developing a novel in-line x-ray monochromator system for x-ray photoelectron spectrometers based on diamond-tipped x-ray anode technology.

### ABOUT THE SPONSOR

The Technology Strategy Board is a business-led organisation established by the Government. Its mission is to accelerate research into, and development and exploitation of, technology and innovation for the benefit of UK business – building economic growth and quality of life.

### FAST FACTS

- As a result of the KTP, there is patent pending on the in-line x-ray monochromator design and further funding (SMART award) for prototype development has recently been received from the TSB.
- The KTP has enabled the company to develop a superior quality aluminium coating with improved thermal transport for X-ray anodes manufactured by Torr.
- The KTP has contributed to the company's strategy in forging closer working relationships with universities and research establishments.
- Working with the University of Surrey on this KTP has enabled Torr Scientific to initiate a new high-tech product range for UHV surface science systems.
- The enhanced processes and knowledge could also be applied to other product opportunities.
- The KTP Associate has become an integral part of the team.

## The Company



*"The KTP project has been of great benefit to Torr Scientific. The company has significantly advanced its knowledge, process and product quality, which has raised company profile within surface science and business networks"*

*David Bates & Mel Thomas, Directors, Torr Scientific Limited (TSL)*

TSL specialises in the manufacturing and supply of vacuum related instrumentation. TSL has a competitive advantage in the x-ray source market through their leading edge diamond-tipped high power x-ray anode technology. In addition, the company offers an extensive range of UHV viewports (e.g. with anti-reflective coatings, transparent conducting oxide coatings, lead glass assemblies etc.) to meet a variety of transmission requirements.

The company exports 40% of sales and customers include OEMs (XPS/XRF systems manufacturers), end-users (e.g. universities) and branded resellers of vacuum equipment.

### ABOUT THE PROJECT

In order to maintain growth, the company aimed to keep a technical edge and wanted to enhance and extend its manufacturing capabilities through further development of high power diamond-tipped x-ray anode with the introduction of a novel in-line x-ray monochromator x-ray source.

The new product will enable TSL to penetrate the high-tech scientific component market and significantly expand its business.

The partnership with the University of Surrey provided Torr Scientific with important expertise in thin film technologies, key to establishing a new durable diamond-tipped x-ray anode for the in-line x-ray monochromator (and useful for other TSL anode designs for XPS and XRF), access to characterisation equipment for thin film R&D, important for development, assembly (and other TSL products) and test facilities beyond the financial means of TSL.



[www.torrscientific.co.uk](http://www.torrscientific.co.uk)

TSL had recently developed a novel 'diamond-tipped' x-ray anode which can offer an increase in power of 100% over standard x-ray anodes for x-ray photoelectron spectroscopy and x-ray fluorescence. Based on this capability, TSL had draft designs for a novel in-line x-ray monochromator using (a modified version of) the current diamond-tipped x-ray anode and further employing a compact electron gun and Bragg crystal in a single port in-line package.

This in-line x-ray monochromator would offer improvements in power (up to 10 times greater), spot size (up to 2 times smaller), ease of calibration and lower cost (potentially less than half that of current systems).

There is untapped demand within the x-ray surface science spectroscopy marketplace for this low cost, compact, higher power and smaller spot size monochromator. Developing the new monochromator system would enable TSL to offer this new product both to existing surface science system clients and as a bolt-on product.

The KTP with the University of Surrey provided ready access to necessary academic expertise and facilities that assisted developing the necessary technical capabilities within TSL to enable the rapid introduction of a new in-line x-ray monochromator source into the x-ray surface science spectroscopy marketplace.

## Benefits included:

**Knowledge** – Use of Dr Baker's knowledge of various different thin film and coating systems, combined with access to current research literature and materials characterisation facilities gave the company a much stronger R&D team which could develop the processes and materials solutions in the required time frame.

**Test facilities** - The Surface Analysis Laboratory at Surrey is equipped with two x-ray photoelectron spectrometers and one of these two spectrometers was designated as an x-ray anode and monochromator test bench.

**Training and Development** - The Associate needed to become familiar with XPS and was trained in the technique fundamentals and instrumentation usage at Surrey. The Associate presented a poster at an International Vacuum Congress.

**Materials characterisation facilities** – The many materials characterisation techniques available to the KB team (SEM, XPS, XRD) enabled the thin films deposited to be examined in detail and correlations to be drawn between deposition conditions and coating microstructure.

**Knowledge Transfer** - Techniques developed through the KTP project with support of the University facilities were transferred to employees and procedures at TSL to deliver the product enhancements and development opportunities within commercial time-frames.

**Market understanding** - The partnership also led to Torr increasing their knowledge of the

international XPS research community and access to research literature on the latest thin film and scientific instrument developments.

## RESULTS

- ❖ The development of a novel in-line x-ray monochromator design (patent pending) and initiation of a new high-tech product range for the company
- ❖ Direct sales opportunities for advanced products to existing and new OEM customers and service suppliers
- ❖ Wider impact through a better understanding of the principles and processes involved with all of TSL's products based on thin film and hermetic seal technology
- ❖ The improvement of thin film quality for x-ray anode coatings and the progression of diamond tipped x-ray anode development
- ❖ Development of market leading products and strengthen position in market
- ❖ Increased sales of £1.2M per year and increased net profit of £500k per year expected within 5 years
- ❖ Embedding of new research skills and knowledge, scientifically proven and academically grounded
- ❖ Improved and expanded technical capabilities within TSL to enhance overall quality, product profile, competitiveness and cost efficiency
- ❖ Further development of the in-line x-ray monochromator has been funded by the TSB through a SMART award

## The Associate

*"The KTP programme has given me a major career boost. The journey was demanding both technically and personally, but ultimately very rewarding and has led to an Industrial Doctorate programme for me"*

*David Stupple, KTP Associate*

The Associate developed an in-depth understanding of TSL's products and processes, in particular, those for the diamond-tipped x-ray anode. This involved significant interaction and liaison with TSL's small technical team, external consultants/designers and the KB team. Development of the x-ray monochromator further required the Associate to acquire skills in electron optics, electron and thermal transport modelling, instrument design and understand the operation of XPS spectrometers.

Optimising the new basic x-ray source and in-line monochromator design also required a good understanding of customer demands. Consequently there was constant interaction with the Sales and Marketing team and regular liaison and participation in meetings with consultants and customers.

### BENEFITS

Throughout the project, David gained invaluable technical and practical expertise in instrument design and development and following project end, he embarked on a 4 year Eng D programme at Surrey and hopes to become a key member of the TSL technical team in the future.

### RESULTS

- ❖ Substantially enhanced technical skill set & expertise in thin film growth and x-ray photoelectron spectroscopy
- ❖ Participation in an International Vacuum Congress
- ❖ Improved knowledge of the vacuum instrumentation commercial sector marketplace

## The Academic Partner



*"This KTP has been a really fascinating project. I have been very excited by the opportunity to apply my knowledge of thin film growth and materials characterisation techniques in working*

*with TSL to develop this new state-of-the-art surface science product"*  
*Dr Mark Baker, the University of Surrey*

The Faculty of Engineering and Physical Science's Surface Analysis Laboratory, established for over 30 years, houses instrumentation worth over £3M and is regarded as one of the most important facilities in Europe. The laboratory has a history of developing special in-situ testing facilities for undertaking novel experiments.

### BENEFITS

Collaboration with Torr Scientific enabled the KB team, Dr Mark Baker and Professor John Watts to extend their involvement with instrument development to new high power x-ray sources and x-ray monochromators. These products were of great interest to Surrey, as they could offer an improvement in the spatial resolution of XPS beyond current state-of-the-art limits and hence open up exciting new materials applications. The reputation of the KB team also benefited from involvement with such cutting-edge instrument development.

### RESULTS

- ❖ Commercial application of technical knowledge and expertise
- ❖ Participation in the development of a novel state-of-the-art component for x-ray photoelectron spectroscopy
- ❖ Long term collaboration with an ambitious scientific SME

