4th August 2014

Johnson Matthey, Oxford University and Diamond Light Source to Invest in New Capability for Materials Analysis

Today Johnson Matthey, Oxford University and Diamond Light Source announce the creation of a state-of-the-art materials characterisation facility at the Harwell Science and Innovation Campus. This world class site is close to both Oxford University and Johnson Matthey's Sonning Common Research laboratories and is home to Diamond, the UK's synchrotron science facility, where currently 24 experimental stations (beamlines) are operational with funding in place to increase this number to 33 by 2018.

As part of Diamond's pioneering hard X-ray nanoprobe beamline (I14) and electron microscopy centre, Johnson Matthey and Oxford University will each contribute cutting-edge microscopes from JEOL to support research in the Physical Sciences. These microscopes will complement two other advanced electron microscopes that will also be built at the new centre as part of a National Facility for Cryo-Electron Microscopy. Overall, the new centre will offer unrivalled facilities for research across biological and physical sciences.

The hard X-ray nanoprobe will take structural analysis with detailed element mapping to the highest spatial X-ray resolution available anywhere in the world. Oxford University will bring a unique JEOL 300kV electron microscope dedicated to atomic scale imaging at world-leading resolution and Johnson Matthey will install a world-leading JEOL double-EDX and EELS capable microscope dedicated to chemical analysis with atomic scale resolution. Collaborations between Johnson Matthey, Oxford University and Diamond's I14 beamline will facilitate the interchange of samples between these systems and enable analyses at near-duty catalytic conditions to observe the influence of chemical and thermal challenges on material structure.

Commenting on this development:

Dr Elizabeth Rowsell (Director, Johnson Matthey Technology Centre) said "This is an exciting development for Johnson Matthey research, we chose to bring our investment to Diamond's I14 beamline to further strengthen our extensive collaborations in advanced characterisation";

Professor Andrew Hamilton, (Vice-Chancellor of Oxford University), said: "Bringing together these powerful instruments in one place will be hugely beneficial to researchers, both in academia and industry, who are studying materials at the atomic scale. This new facility could lead to advances in many exciting research areas including graphene technology and the development of cleaner, greener fuels."

Mr. Koichi Fukuyama (Director JEOL Europe) said "This is a wonderful opportunity for JEOL and we are excited to be supporting the advanced characterisation research facilities that are being planned for the benefit of both academic and industrial scientists from the UK and beyond."

Professor Andrew Harrison (CEO Diamond Light Source) said “We welcome closer engagement with UK companies such as JM. This development is part of a more general trend to develop strategic partnerships with industry and university, often underpinned by investment in complementary equipment or people, to exploit more fully our synchrotron facilities”;

The I14 hard X-ray nanoprobe beamline will offer experimental facilities that are world leading. It will be the third of four beamlines at Diamond that need to extend beyond the iconic silver doughnut shaped building due to the type of experiments it will enable scientists to carry out.

To maximise the distance from the focusing optic to the sample, I14 will extend beyond the main building to a distance of approximately 175m. The beamline will provide a state of the art facility in which a focused x-ray spot is positioned or scanned over a sample. Samples under investigation will include a wide range of organic and inorganic materials. The potential applications are extremely varied and include materials science, in areas such as new polymers, magnetic and nano-structured materials. Earth and environmental science and geochemistry, with potential research topics including aerosols, minerals, sediments, soils and bio-remediation. The beamline and associated microscopy facilities will also be able to investigate new energy sources and area of biological, biotechnological and biomedical science such as new biomaterials and the elemental imaging of cells.

The facility will have the potential to investigate samples under both static or real (e.g. wet, heated, in situ strain) conditions. The aim being to allow scientists to obtain both structural and chemically-specific information.

The beamline, which will come online in spring 2017, will be a dedicated facility for micro-nano small angle X-ray scattering (SAXS) and nanoscale microscopy. It will serve 2 end-stations. One will be a nanoprobe for which the design priority will be to achieve the smallest possible focus, with a development goal of 10 nm and initial aim of 30 nm. The optical design will be optimised for scanning X-ray fluorescence, X-ray spectroscopy and diffraction. The other station will be optimised to carry out small and wide angle X-ray scattering studies as well as scanning fluorescence mapping with a variable focus beam in the range 5µm – 100 nm.

Complementing the beamline information, the electron microscopes, through EDX, EELS, atomic scale imaging and electron diffraction, show the identity, ordering and chemical state of atoms in the sample. The potential of today’s advanced materials depends upon the structures and properties that arise from collections of atoms interacting in their local environment. In automotive emissions control catalysts, fuel cells, chemical process technology and battery materials the collections of atoms are the catalytically active sites and characterising those leads to better understanding and their improved design. At greater length scales, framework materials such as graphene, zeolites or complex ceramics provide controlled transmission of active effects from clusters of atoms to greater length scale properties. The expertise and equipment that Johnson Matthey, Oxford and Diamond bring together will provide the nucleus for the community to come together and address important future challenges.

About Diamond Light Source

Diamond Light Source is funded by the UK Government through the Science and Technology Facilities Council (STFC), and by the Wellcome Trust.

Diamond generates extremely intense pin-point beams of synchrotron light. These are of exceptional quality, and range from X-rays to ultra-violet to infrared. For example, Diamond's X-rays are around 100 billion times brighter than a standard hospital X-ray machine.

Diamond Light Source is used by over 3,000 academic and industrial researchers across a wide range of disciplines, including structural biology, health and medicine, solid-state physics, materials & magnetism, nanoscience, electronics, earth & environmental sciences, chemistry, cultural heritage, energy and engineering. Many everyday commodities that we take for granted, from food manufacturing to consumer product, from revolutionary drugs to surgical tools, from computers to mobile phones, have all been developed or improved using synchrotron light. For more information about Diamond visit www.diamond.ac.uk

About Johnson Matthey

Johnson Matthey is a global speciality chemicals company underpinned by science, technology and its people. A leader in sustainable technologies, many of the group's products enhance the quality of life of millions through their beneficial impact on the environment, human health and wellbeing.

Johnson Matthey has operations in over 30 countries and employs around 12,000 people. Its products and services are sold across the world to a wide range of advanced technology industries. Visit www.matthey.com

About the University of Oxford

The University of Oxford has more world-leading academics (rated 4* in the 2008 national Research Assessment Exercise) than any other UK university. Oxford also has the highest number of world-leading or internationally excellent (4* or 3*) academics in the UK. Oxford consistently has the highest research income from external sponsors of any UK university. www.ox.ac.uk

About JEOL

JEOL is a leading global supplier of scientific instruments used for research and development. Utilizing its unique technologies, products, services, and knowledge, JEOL helps its customers make significant breakthroughs in product development and scientific research. JEOL pursues the world's highest technology based on creativity and research and development, thus contributing to progress in both science and human society through its products. For more information visit www.jeol.com

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Photo taken at the building site area of I14 beamline and the Materials Characterisation Facility
L/R: Yasuo Takemitsu (JEOL), Julia Parker, Diamond beamline scientist (I14), Trevor Rayment, Diamond's Physical Sciences Director, Paul Collier, Johnson Matthey Research Fellow, Dogan Ozkaya, Johnson Matthey, Peter Ash, Technology Manager: Advanced Characterisation, Johnson Matthey Technology Centre, Andrew Harrison, CEO of Diamond Light Source, Elizabeth Rowsell, Director, Johnson Matthey Technology Centre, Sarah Karimi (JEOL), Andrew Richards, Diamond's Legal Manager, Elizabeth Shotton Diamond's Head of Industrial Liaison, Paul Barrett, Diamond's Commercial Manager

Photo taken in the Diamond Board Room
Back row L-R: Yasuo Takemitsu (JEOL), Peter Ash, Technology Manager: Advanced Characterisation, Johnson Matthey Technology Centre, Paul Collier, Johnson Matthey Research Fellow, Sarah Karimi (JEOL), Trevor Rayment, Diamond's Physical Sciences Director, Dogan Ozkaya, Johnson Matthey, Elizabeth Shotton Diamond's Head of Industrial Liaison
Front row: Elizabeth Rowsell, Director, Johnson Matthey Technology Centre, Andrew Harrison, CEO of Diamond Light Source

Photos courtesy of Diamond Light Source