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NEWS

SCIENCES

Phase-contrast X-ray micro-tomography unveils tiny Cretaceous plant mesofossils (November 22, 2007)

At the TOMCAT beamline of the Swiss Light Source at the Paul Scherrer Institute, a phase-contrast X-ray tomographic microscope was recently applied to some very interesting research—the identification and classification of small fossil seeds (0.5~1.8 mm long) of the Early Cretaceous in Portugal and North America. The conclusion is that these seeds belong to *Gnetales* and to *Bennettitales*. The experiment used a very fast tomography method, the algorithm of which was introduced by Bronnikov, and refined by Gureyev. For more information, see the paper, *"Phase-contrast X-ray microtomography links Cretaceous seeds with Gnetales and Bennettitales"*, E. M. Friis et al., Nature, **450**, 549–552 (2007).

Ultrafast 3D imaging in soft X-ray region (November 1, 2007)

Lensless Fourier transform holography (FTH) is known as an imaging method suitable for high resolution X-ray microscopy with coherent X-rays. In FTH, there had been a limit on the spatial resolution, mainly because of the contradiction between the requirement on the numerical aperture and the realistic resolving power of high spatial frequency fringes that appeared in the hologram. Multiplexing, i.e., the use of multiple object and reference signals, can be one promising solution, because it extends the effective field of view. Recently, a research group led by Professor J. Stöh, a director of Stanford Synchrotron Radiation Laboratory (SSRL), has developed the technique further so that the measurement can be done by a single shot. Using patterned masks to provide multiple X-ray sources, the team demonstrated the ability to record images simultaneously at different parts of the sample. 3D imaging of ultrafast processes could become a reality if the method is combined with so-called pump-probe experiments. For more information, see the paper, *"Extended field of view soft x-ray Fourier transform holography: toward imaging ultrafast evolution in a single shot"*, W. F. Schlotter et al., Optics Letters, **32**, 3110–3112 (2007).

Table-top X-ray diffraction microscopy (August 31, 2007)

The use of coherent X-rays makes it possible to replace lenses by signal processing in X-ray imaging techniques, as demonstrated for the first time in 1999 (See, J. Miao et al., Nature, **400**, 342 (1999)). The current state-of-the-art technique uses radiation produced by a free-electron laser, which, in a single shot, images with a temporal resolution of 25 fs and a spatial resolution of 90 nm. Very recently, a group led by Professors H. Kapteyn and M. Murnane (University of Colorado, Boulder, USA) has succeeded in performing this kind of measurement in an ordinary laboratory, instead of at a synchrotron facility, using 29 nm soft X-rays generated as 25–31th order harmonics from a 1.3 mJ, 25 fs, Ti:S laser. The team collected scattering from the sample by means of an X-ray CCD camera. The spatial resolution of the reconstructed images is 214 nm. For more information, see the paper, *"Lensless Diffractive Imaging Using Tabletop Coherent High-Harmonic Soft-X-Ray Beams"*, R. L. Sandberg et al., Phys. Rev. Lett. **99**, 098103 (2007)

PROFESSIONAL

Pittcon 2008 releases topics for Conferee Networking Sessions (November 9, 2007)

The Pittsburgh Conference has released the topics for the Conferee Networking Sessions (CNS) which will be offered at Pittcon 2008, March 2–7, 2008, in New Orleans at the Ernest N. Morial Convention Center. The sessions were first introduced at Pittcon 2007, and the number has been increased to 27 for Pittcon 2008. Some of the topics included in the 2008 program are "Management and Certification of Reference Standards", "Analysis of Explosives and Energetics: From Forensic/Trace to Production Support", "Green Chemistry/Green Chemists in the Office, Lab and Schools: What Can I Do to Make our World "Greener"", "Information Management and Data Handling in the Laboratory", "Chemical Imaging: Instrumental and Analysis" etc. For further information, visit http://www.pittcon.org/

FLASH achieves 6.5nm wavelength (October 14, 2007)

FLASH, which is the European free-electron laser (FEL) facility located in DESY's campus in Hamburg, recently achieved a world first by generating flashes of laser light at the wavelength of 6.5 nm, which is much shorter than the previous record of 13.5 nm that the same facility established one year ago. During the past several months, the linear accelerator (260 m) has been extended by a further 12 m by installing the 6th superconducting module. This has enabled the acceleration of the electron beam up to 1 GeV, the designed energy. The FLASH facility has been available for user experiments since August 2005. Until 2009, it will be the only facility in the world that can provide FEL in the soft X-ray region. The next user run will begin in mid-November this year and last 13 months. The international expert committee has already selected 32 projects. The present 6.5 nm soft X-ray laser will be used for the experiments. For further information, contact Petra Folkerts, Phone: +49 40-8998-4977, Fax: +49 40-8998-2020, presse@desy.de, http://www.xfel.eu

Argonne's Center for Nanoscale Materials fully operational (October 2, 2007)

The Center for Nanoscale Materials (CNM) at the Department of Energy's Argonne National Laboratory has been declared fully operational. The CNM building opened for research in May 2006 and, since then, approximately 50 user projects have been able to take advantage of the facility. Very recently, the hard X-ray nanoprobe beamline was completed, and a Beowulf-class supercomputer array with 12

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teraflop capacity installed. For further information, contact Steve McGregor, Phone: +1-630-252-5580, media@anl.gov, http://www.anl/gov/

NEW PRODUCTS

Oxford Instruments launches INCAx-act with PentaFET Precision (November 26, 2007)

Oxford Instruments has announced the launch of its silicon drift detector (SDD), INCAx-act with PentaFET Precision. The detector uses a unique silicon drift sensor in combination with the external FET and digital pulse processor. Oxford Instruments claims the detector is particularly superior in the low energy region—near carbon lines—and is the world's only SDD to offer ISO 15632:2002 resolution compliance. For further information, visit http://www.oxford-instruments.com/

Samsung's X-ray flat panel detector (November 22, 2007)

Samsung Electronics has announced recently that it has completed development of a flat panel X-ray detector for radiology machines, in collaboration with Vatech Ltd, a Korean medical machinery manufacturing company. The new detector measures 45 cm × 46 cm and boasts 3072 × 3072 pixels, providing ultra-high quality images. For further information, visit http://www.samsung.com/us/

Bruker AXS announces Microstar Ultra II (November 15, 2007)

Bruker AXS has announced its new Microstar Ultra II, the newest version of a bright X-ray source mainly designed for structural biology. The source employs new electron optics (Ultra Focus™, patent pending) to enhance intensity to the equivalent of a doubling of the anode rotation frequency. For further information, visit http://www.bruker-axs.com/

Shin-Etsu releases lead-free X-ray shields (November 12, 2007)

Shin-Etsu Polymer has recently announced the release of completely lead-free X-ray shielding sheet (950mm × 950mm × 4.5mm(t)). The product is made of a barium-base inorganic material and resins; and it is flexible and suitable for any type of machining. The price is 20,000 JPY/sheet. For further information, visit http://www.shinpoly.co.jp/english/index.html

Toshiba prepares advanced multi-slice CT system (November 9, 2007)

X-ray computer tomography (CT) is a method of visualizing the inside of objects. In medical applications of CT, it is important to shorten the exposure time in order to minimize the X-ray dose, with the result that detector arrays have been employed in place of a single detector. These are called multi-slice CT systems, and Toshiba Medical Systems Corp. is competitive in this technology. The maximum number of arrays employed so far has been 64, but Toshiba very recently developed a system with 256 arrays, the prototype of which it presented at an open meeting. The product will be announced in the near future. In April 2007, Toshiba released its most recent model, the Activion 16 system, which has 64 arrays. For further information, visit http://www.toshiba-medical.co.jp/tmd/english/index.html

Thermo Fisher Scientific introduces X-Ray Master Sensor (November 7, 2007)

Thermo Fisher Scientific recently announced the introduction of its X-Ray Master Sensor, which provides non-contacting, scanning measurement of weight, thickness or composition of a material on a moving web. The sensor is equipped with a stable low-noise X-ray source, which is digitally tuned across the ranges 10 to 30 keV depending on the material to be measured. For further information, visit http://www.thermo.com/

PANalytical's new MiniPal 4 Sulfur (October 1, 2007)

The new MiniPal 4 Sulfur is the latest in PANalytical's line of compact, benchtop energy dispersive X-ray fluorescence (EDXRF) spectrometers for petrochemicals. The instrument is one of the smallest full-function spectrometers available. It is equipped with a 12-position sample changer; three tube filters, a helium gas attachment for light element analysis and a 15 kV silver anode tube, the latter selected to give optimum performance for phosphorous, sulfur and chlorine analysis. The system also features a new silicon drift detector. For further information, visit http://www.panalytical.com/

Amptek adds silicon drift detector to its range (July 15, 2007)

The XR-100SDD Silicon Drift Detector (SDD) is Amptek's latest addition to its line of compact X-ray detectors. The detector does not need liquid N_2 and has an energy resolution of 139 eV (FWHM) at 5.9 keV when the peaking time is set as 9.6 μs, which corresponds to the maximum counting rate of 100,000 counts/sec. It is possible to obtain X-ray spectra at an even higher counting rate, such as 500,000 counts/sec, with a reasonably small sacrifice of energy resolution (~190eV). The product will be available in early 2008. For further information, visit http://www.amptek.com/

CORPORATE

Rigaku announces XRF training course (November 5, 2007)

Rigaku's next training session (3 days) for X-ray fluorescence analysis will take place on February 5–8, 2008. For further information, visit http://www.rigaku.com/index_en.html

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For additional news about X-ray analysis and other spectroscopy sciences, please browse the Wiley website. http://www.SpectroscopyNow.com

Kenji Sakurai
News Editor
sakurai@yuhgiri.nims.go.jp
or sakurai@pas.tsukuba.ac.jp

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NEWS

SCIENCES

Near-field speckle in coherent X-Ray scattering (January 20, 2008)

A coherent X-ray beam produces a speckle pattern when it impinges on a sample. Usually the size and shape of the speckle do not depend on the sample at all, but a group led by Professor M. Giglio (Universita degli Studi di Milano, Italy) recently found significant effects, observed when the detector is placed in the near field. Conventional far-field techniques, because of the van Cittert and Zernike theorem, have limitations in the statistical analysis of speckles, but it has now become possible to generate static and dynamic X-ray-scattering data. In addition, the present technique permits an increase of around four orders of magnitude in beam size and power. The measurements were done at BM05, European Synchrotron Radiation Facility (ESRF) in Grenoble, France. The peak energy was 12 keV and the beam size at the sample position was 1 mm × 1 mm. For more information, see the paper, *"X-ray-scattering information obtained from near-field speckle"*, R. Cerbino *et al.*, Nature Physics, advanced online publication, DOI: 10.1038/nphys837.

Quantitative reconstruction of layered materials by 3D XRF (January 8, 2008)

A German group led by Dr. B. Kanngiesser (Technische Universitat Berlin) has recently reported the significant extension of 3D micro X-ray fluorescence (XRF) spectroscopy. Conventional XRF mapping is likely to remain a non-absolute analysis, since it just gives the spatial distribution of elements in the viewing region. On the other hand, most realistic analytical applications require much greater quantitative imaging of chemical composition, density, thickness of layers etc. The research group attempted to introduce a reliable quantification procedure, and obtained successful results in the case of stratified material. For more information, see the paper, *"Reconstruction of Thickness and Composition of Stratified Materials by Means of 3D Micro X-ray Fluorescence Spectroscopy"*, I. Mantouvalou *et al.*, Anal. Chem. ASAP Article, DOI: 10.1021/ac701774d.

A compact synchrotron light source driven by pulse laser (December 9, 2007)

Ultrashort X-ray photon pulses are powerful tools for time-resolved studies of molecular and atomic dynamics. Free electron lasers remain the most promising source. However, in the future, developing much more compact sources will become significant in widening the field of application. A group led by Professor D. A. Jaroszynski (University of Strathclyde, UK) has recently reported the first successful combination of a laser-plasma wakefield accelerator, producing 55–75 MeV electron bunches, with an undulator to generate visible synchrotron radiation. Here, the key would be the laser wakefield accelerator, which produces electron beams with energies from tens of MeV to more than 1 GeV within a few cm, with pulse durations of several fs. Further improvements, particularly in the energy of electrons, could contribute to the generation of X-ray photons with ultrashort pulse-width as well as extremely high peak power. For details on laser-plasma wakefield acceleration, see, for example, *"Accelerator physics: Electrons hang ten on laser wake"*, T. Katsouleas, Nature, **431**, 515–516 (2004). For more information on the present experiments, see the paper, *"A compact synchrotron radiation source driven by a laser-plasma wakefield accelerator"*, H.-P. Schlenvoigt *et al.*, Nature Physics, advanced online publication, DOI: 10.1038/nphys811.

Pulse X-Ray photons catch shock-induced lattice deformation in 100 ps time scale (December 7, 2007)

The lattice dynamics of materials under high strain is of great interest in materials science. Japanese scientists led by Professors S. Adachi (KEK, Tsukuba) and S. Koshihara (Tokyo Tech Institute, Tokyo) have recently succeeded in observing the irreversible deformation process of CdS single crystal by single-shot time-resolved Laue diffraction. The time-resolution here is 100 psec, which is a single-bunch X-ray pulse-width, available at the Photon Factory-Advanced Ring (6.5 GeV). The data was obtained with various time delays in the order of nsec. As the observed pattern exhibits six-fold symmetry of the wurtzite structure at 10 ns, corresponding to a shock pressure of 3.92 GPa, i.e., above the threshold pressure of phase transition to a rocksalt structure, they suggest a transient wurtzite structure. For more information, see the paper, *"Shock-induced lattice deformation of CdS single crystal by nanosecond time-resolved Laue diffraction"*, K. Ichiyanagi *et al.*, Appl. Phys. Lett. **91**, 231918 (2007).

Energy-dispersive XRS in transmission electron microscope unveils mysteries of solid-liquid system (November 30, 2007)

For many years, the simultaneous mapping of phases and chemical compositions subjected to extreme conditions has been one of biggest challenges in materials science. Professor J. M. Howe (Virginia University, USA) and his colleagues have reported the successful study of partially molten Al-Si-Cu-Mg alloy particles, for automobile and aerospace applications, during in situ heating by energy-dispersive X-ray spectroscopy in a transmission electron microscope. They have discovered some significant results, for instance, Al and Si concentrations change in a complementary and symmetric manner about the solid-liquid interface as a function of temperature. They also obtained direct evidence for homogeneous nucleation of the Al-rich solid. For more information, see the paper, *"In Situ Determination of the Nanoscale Chemistry and Behavior of Solid-Liquid Systems"*, S. K. Eswaramoorthy *et al.*, Science, **318**, 1437–1440 (2007).

Reference-free trace element determination by TXRF (October 15, 2007)

Dr. B. Beckhoff (Physikalisch-Technische Bundesanstalt, Berlin, Germany) and his colleagues have successfully performed a reference-free quantitation by total reflection X-ray fluorescence (TXRF) analysis in the soft X-ray region. So far, element determination by XRF has been usually done with a calibration curve, which requires some reference samples. However, there have been increasing demands for reference-free analysis, particularly in cases where stable and reliable reference samples are not easily obtained. The fundamental parameter method, which is one of the most promising ways of performing such reference-free analysis, uses the theoretical XRF intensity expressed by Sherman's equation (or Fujino-Shiraiwa's formula), but appears to be highly dependent on geometrical factors, the spectral distribution of primary X-rays, and atomic fundamental constants etc. In TXRF, the intensity is affected by additional conditions. The experiments were done with monochromatic synchrotron radiation, at BESSY II. The research group has developed a feasible sample chamber specially designed for quantitative XRF. In addition, several calibrated detector systems have been employed to obtain reliable results. For more information, see the paper, *"Reference-Free Total Reflection X-ray Fluorescence Analysis of Semiconductor Surfaces with Synchrotron Radiation"*, B. Beckhoff *et al.*, Anal. Chem. **79**, 7873–7882 (2007).

PROFESSIONAL

8th Ewald Prize — D. Sayre (January 21, 2008)

The international union of crystallography (IUCr) announced that Professor D. Sayre (Department of Physics, State University of New York, Stony Brook, NY 11794, USA) has been awarded the eighth Ewald Prize for the unique breadth of his contributions to crystallography, which range from seminal contributions to the solving of the phase problem to the complex physics of imaging generic objects by X-ray diffraction and microscopy, and for never losing touch with the physical reality of the processes involved. The presentation of the Ewald Prize will be made during the Osaka Congress Opening Ceremony in August 2008. Former recipients of the Ewald Prize are P. Coppens (USA, 2005), Michael M. Woolfson (UK, 2002), G. N. Ramachandran (India,

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1999), M. G. Rossmann (USA, 1996), N. Kato (Japan, 1993), B.K. Vainshtein (Russia, 1990), J.M. Cowley (USA) and A.F. Moodie (Australia) in 1987.

Three US Scientists awarded 2008 Japan Prize (January 17, 2008)

The Science and Technology Foundation of Japan has announced that three US scientists have been named as laureates of the 2008 (24th) Japan Prize. Dr. Vinton Gray Cerf, 64, Google Inc., and Dr. Robert Elliot Kahn, 69, Corporation for National Research Initiatives, have received the prize in this year's category of "Information Communication Theory and Technology". Dr. Victor A. McKusick, 86, the Johns Hopkins University, has been selected in another prize category of "Medical Genomics and Genetics." They will receive certificates of merit, and commemorative medals. There is also a cash award of fifty million Japanese yen for each prize category. The presentation ceremony is scheduled to be held in Tokyo at the National Theatre on Wednesday 23rd April, 2008. The prize categories for the 2009 (25th) Japan Prize will be "The transformation towards a sustainable society in harmony with nature" and the "Technological integration of medical science and engineering". For further information, contact Masaaki Ueda, The Science and Technology Foundation of Japan, Phone: +81-3-5545-0551, Fax: +81-3-5545-0554, info@japanprize.jp, http://www.japanprize.jp/English.htm.

The 1st X-Ray reflectivity school in Japan (November 29, 2007)

The 1st tutorial course on the analysis of thin films and multilayers by X-ray reflectivity was held in Tsukuba, Japan, on November 29–30. The first and second days were for beginners and experts, respectively, but most of the total of 63 participants attended both of them. The textbook distributed at the school will be published in 2008. The 2nd course will take place in March 2008. Further information is available at http://www.nims.go.jp/xray/ref/(in Japanese only).

NEW PRODUCTS

Malvern's latest chemical imaging analysis software (January 22, 2008)

Malvern Instruments has announced the release of ISys 5.0, the latest version of its chemical imaging analysis software. ISys 5.0 builds on already strong support for third party platforms. For more information, visit http://www.malvern.com/.

SLICE software now available from HORIBA Jobin Yvon (January 10, 2008)

HORIBA Jobin Yvon has announced that it has agreed with xk, Inc. to become the exclusive provider of SLICE software to the XRF community. SLICE, the Spectral Library Identification and Classification Explorer, is designed to archive, query, and compare X-ray spectra. The software was developed under an FBI contract to save time and improve the accuracy of evidence identification, and to create an advanced archiving tool, allowing spectra, images, and text to be seamlessly linked. It has become a widely-used tool in forensic laboratories where virtually any material can be encountered, and its use is now being extended to contaminant analysis in a wide range of industries, including the pharmaceutical, automotive, engine wear and semiconductor industries. For more information, contact Simon FitzGerald, Phone:+44-20-8204-8142, info@jobinyvon.co.uk, http://www.jobinyvon.co.uk.

Rigaku's energy-dispersive XRF Spectrometer (December 19, 2007)

Rigaku has announced the release of its EDXL 300, which is an energy-dispersive X-ray fluorescence spectrometer equipped with efficient optics based on exchangeable secondary targets as well as a Si drift detector. The spectrometer covers a wide range of applications from environmental analysis to inspection and screening in industries. For further information, visit http://www.rigaku.com/index_world.html.

CORPORATE

Bruker Acquires Elemental Analysis Company JUWE Laborgeraete GmbH (January 3, 2008)

Bruker AXS GmbH has announced that it has signed an agreement to acquire all of the equity of privately-held JUWE Laborgeraete GmbH, which has many years of experience in combustion analysis of light elements such as C, H, N, O and S. A stock purchase agreement was signed on December 21, 2007 and the transaction is expected to close in the first quarter of 2008. JUWE's estimated 2007 revenue was approximately $3 million. For further information, contact Michael Willett, Phone: +1-978-663-3660, ext. 1411, ir@bruker-biosciences.com, http://www.bruker-axs.com/

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Kenji Sakurai
News Editor
sakurai@yuhgiri.nims.go.jp
or sakurai@pas.tsukuba.ac.jp

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BOOK REVIEW

"Topics in X-Ray Spectrometry" (C. Vazquez (Ed.), Comision Nacional de Energia Atomica, 216 pages, ISBN-978-987-1323-04-3)

A very useful XRS booklet has recently been published in Argentina. Seven chapters are contribution of the authors from South America (Mexico, Brazil, Venezuela and Argentina) and the rest three are from Europe (Austria and Belgium). This booklet could be used as a textbook in tutorial workshops for newcomers to XRS, because it covers a lot of ground ranging from the fundamental aspects of XRS right through to almost all the important applications, as well as providing key knowledge for practical analysis such as sample preparation. In addition, it is full of comprehensive figures, photos and tables that are large enough to view even if one is simply flipping through the pages. The booklet covers not only XRS in general, but also detailed information on TXRF, which has become particularly popular in South America. In the preface, the editor of the book, Professor Cristina Vazquez, comments on the long history of X-rays after their discovery by Roentgen in 1895. Nowadays, X-ray analysis is one of the most widely used scientific tools. Synchrotron sources are available worldwide (except unfortunately in Africa—in South America, one synchrotron is operating in Sao Paulo, Brazil). The publication of such an excellent XRS textbook (as well as the holding of good conferences and tutorial workshops) is significant in preparing the way for the next generation of students so that they too can go on to create history.

SCIENCES

Analysis of trace cadmium in the environment (April 1, 2008)

Cadmium is one of the most ecotoxic metals. A Spanish and Belgian research group led by Dr. M. Hidalgo (University of Girona, Spain) has recently reported the determination of trace Cd in complex environmental liquid samples. The method employed is basically a combination of a pre-concentration technique and Cd Kα XRF analysis with a high-energy polarized beam (PANalytical Epsilon 5 with a Gd tube, 100kV-6mA, and a Ge detector). In order to collect trace Cd effectively, the research group used Aliquat 336 (trademark of Cognis Corp.), which is tricaprylmethylammonium chloride ($C_{25}H_{54}ClN$), as an extractant. The typical detection limit is 0.7 μg/L, and the accuracy was investigated by using spiked seawater samples and a synthetic water sample containing, besides Cd, high amounts of other metal pollutants such as Ni, Cu, and Pb. For more information, see the paper, *"High-Energy Polarized-Beam Energy-Dispersive X-ray Fluorescence Analysis Combined with Activated Thin Layers for Cadmium Determination at Trace Levels in Complex Environmental Liquid Samples"*, E. Margui *et al.*, Anal. Chem., 80, 2357 (2008).

Keyhole coherent diffractive imaging (March 9, 2008)

Recent advances in highly brilliant synchrotron sources including soft X-ray free-electron lasers have ushered in many new methods of microscopy. Coherent diffractive imaging (CDI) is one of the most promising ways of determining the nanoscale structures of non-crystalline materials. However, to enable phase determination, the intensity distribution must be sampled at a spacing finer than its Nyquist frequency, which in turn requires the sample to be finite. In other words, there are some limitations in the sample size. Recently, an Australian group led by Professor K. A. Nugent (University of Melbourne) proposed a new method, 'keyhole' CDI, which can reconstruct objects of arbitrary size. In this case, a beam is focused and the object is placed downstream of the focal point so that it is illuminated by a diverging wave. The geometry looks similar to that of in-line holography, but the requirements placed on the source and detector are different. The group attempted imaging by visible light and X-rays, and, using the latter, part of an extended object was imaged with a detector-limited resolution of better than 20 nm. For more information on the present experiments, see the paper, *" Keyhole coherent diffractive imaging"*, B. Abbey *et al.*, Nature Physics, advanced online publication, DOI: 10.1038/nphys896

Determination of beryllium by XRF (March 1, 2008)

Beryllium has exceptional material properties, and because of this, it is an essential element used in the aerospace, computer, electronics, and nuclear industries. For X-rays, it has been widely used as a window material. Dr. B. Zawisza (Silesian University, Poland) has recently reported the determination of beryllium by X-rays. One would think that it is not easy to determine such an extremely light element by XRF. The novel simple idea is indirect determination of cobalt in the precipitates, $[Co(NH_3)_6][Be_2(OH)_3(CO_3)_2(H_2O)_2]\cdot 3H_2O$, fove rmed from hexamminecobalt(III) chloride and ammonium carbonate-EDTA solution. The detection limit of the proposed method is 0.2 mg of beryllium. For more information, see the paper, *"Determination of Beryllium by Using X-ray Fluorescence Spectrometry"*, B. Zawisza, Anal. Chem., 80, 1696 (2008).

Liquid-jet dynamics revealed by ultrafast X-ray phase contrast imaging (January 27, 2008)

Fast liquid jets and sprays, which are complex multiphase flow phenomena, have been one of physics' veiled mysteries ever since the pioneering work by Rayleigh in the 19th century (See, W. S. Rayleigh, *"On the stability of jets"*, Proc. Lond. Math. Soc. 4, 10 (1878)). The main reason is simply that standard microscopy and visible light imaging techniques cannot peer into the dark and murky centers of dense-liquid jets. Recently, Dr. K. Fezzaa and his colleagues (Argonne National Lab, USA) have succeeded in revealing for the first time the morphology and velocity fields of high-speed and highly turbulent jets generated by a gasoline direct injection system. The research group employed ultrafast synchrotron-X-ray full-field phase-contrast imaging. The spatial and time resolutions in the experiments were 5-30 micron and 472 ns, respectively. For more information on the present experiments, see the paper, *"Ultrafast X-ray study of dense-liquid-jet flow dynamics using structure-tracking velocimetry"*, Y. Wang *et al.*, Nature Physics, advanced online publication, DOI: 10.1038/nphys840

Lensless X-ray camera for nano materials (January 18, 2008)

A joint research group from the USA and Australia, led by Dr. J. Miao (University of California-Los Angeles) recently published the first results of resonant X-ray diffraction microscopy for element specific imaging of buried structures with a pixel resolution of 15 nm by exploiting the abrupt change in the scattering cross section near electronic resonances. They performed nondestructive and quantitative imaging of buried Bi structures inside a Si crystal by directly phasing coherent X-ray diffraction patterns near the Bi-MV edge. For more information, see the paper, *"Nanoscale Imaging of Buried Structures with Elemental Specificity Using Resonant X-Ray Diffraction Microscopy"*, C. Song *et al.*, Phys. Rev. Lett., **100**, 025504 (2008).

PROFESSIONAL

Obituary - Daniel Chemla (March 20, 2008)

Daniel S. Chemla, a world-leading physicist at the Lawrence Berkeley National Laboratory, California, USA has died at the age of 67 at his home in Kensington. Dr. Chemla had been ill for four years after suffering a stroke. He had been director of the Materials Science Division, and also of the Advanced Light Source. He also held an appointment as a professor of physics at UC Berkeley. Dr. Chemla was French, born in 1940 in Tunisia, and was a graduate of France's prestigious Ecole Nationale Superieure des Telecommunications. He received his Ph.D. in non-linear optics from the University of Paris in 1972. Dr. Chemla came to the United States in 1981 to work at AT&T's

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famed Bell Laboratories. In 1991, he was recruited to Berkeley Lab by then director Charles Shank, to become the first director of a newly formed Materials Sciences Division. Dr. Chemla earned particular praise because of his great leadership and contribution in resolving the Advanced Light Source's budget crisis. His achievements with the lab's nanoscale work also led the Department of Energy to select the Berkeley Lab for the opening of the first of five Nanoscale Science Research Centers in the US. Dr. Chemla named it "The Molecular Foundry." Dr. Chemla's great talents were not limited to science. He was a master of Karate—he won the 5th degree black belt in karate, the highest rank awarded in Shotokan Karate of America. He translated Master Gichin Funakoshi's *"Karate-do Kyohan"*, the widely accepted karate master text (Kodansha International Ltd. ISBN 0-87011-190-6) into French. Dr. Chemla was elected a Member of the National Academy of Sciences and a Fellow of the American Physical Society. He received the R.W. Wood prize of the Optical Society of America, and the Quantum Electronics Award of the IEEE Laser and Electro-Optics Society, and a Humboldt Research Award. Dr. Chemla is survived by his wife Berit, two children, Yann, an assistant professor of physics at the University of Illinois, Urbana-Champaign, and Britt Chemla Jones, an Art History lecturer in Houston, Texas. His biography was released by Berkeley Lab.
http://www.lbl.gov/today/2008/Mar/21-Fri/chemla-jump.pdf
The San Francisco Chronicle (March 24, 2008) carries an obituary written by David Perlman.

2008 Pittcon Heritage Award — L. Hood (March 2, 2008)

The Chemical Heritage Foundation (CHF) announced that Dr. Leroy Hood (Co-director of the Nano Systems Biology Cancer Center (NSBCC) and President of the Institute for Systems Biology in Seattle, Washington) received the seventh annual Pittcon Heritage Award. Jointly sponsored by the Pittsburgh Conference on Analytical Chemistry and Applied Spectroscopy (Pittcon) and CHF, this award recognizes outstanding individuals whose entrepreneurial careers have shaped the instrumentation community, inspired achievement, promoted public understanding of the modern instrumentation sciences, and highlighted the role of analytical chemistry in world economies. Dr. Hood pioneered the techniques that made the rapid pace of the Human Genome Project possible.

NEW PRODUCTS

Oxford's new handheld XRF spectrometer (March 28, 2008)

Oxford Instruments has announced the launch of an X-ray fluorescence analyzer - the X MET5000 equipped with PentaFETR detector technology. The X-MET5000's major strength is its Light Element Treatment (LET) mode, enabling fast and accurate analysis of heavy elements, even when the sample contains light elements like aluminum and silicon. This has not previously been possible when using only fundamental parameter calibrations. For further information, visit http://www.oxford-instruments.com/

Thermo Fisher Scientific introduces WDXRF Spectrometer for metals, mining, minerals and cement industries (March 17, 2008)

Thermo Fisher Scientific Inc. has launched the enhanced ARL OPTIM'X with SMS-Omega automation. This WDXRF spectrometer is compact, with a footprint of less than $1m^2$. It features fully automated sample preparation and analysis, and is designed for dedicated use in metals, mining, minerals and cement applications. For further information, call +1 800-532-4752, E-mail: analyze@thermofisher.com, or visit http://www.thermo.com/elemental

Bruker's solution for geology, minerals and mining applications (March 15, 2008)

Bruker AXS has announced the launch of GEO-QUANT, a solution that performs quantitative analysis of more than 27 key trace elements in geological materials. GEO-QUANT is specifically designed for the S8 TIGER wavelength dispersive X-ray fluorescence spectrometer. For further information, contact Kai Behrens, product manager of WDXRF, Phone: +49 (721) 595 2958, E-mail: kai.behrens@bruker-axs.de, http://www.bruker-axs.de/

Oxford Instruments releases X-Strata980 (February 5, 2008)

Oxford Instruments' new X-Strata980 is an X-ray fluorescence analyzer which combines a high-power X-ray tube and large LN_2 free detector to measure small areas of complex samples and deliver limits of detection in single-digit ppm. For further information, visit http://www.oxford-instruments.com/

CORPORATE

PANalytical launches new Korean website (March 11, 2008)

PANalytical has launched a new Korean language website, http://www.panalytical.co.kr/

Bruker wins Pittcon editors' choice gold and bronze awards (March 6, 2008)

Over the past 10 years, about 200 of the editors in attendance at Pittcon (Pittsburgh Conference) have selected the best examples of innovative and creative instruments showcased on the exposition floor. The sole criterion is that the nominated products are making their first appearance on the exhibition floor. The 2008 results are as follows, Gold: Bruker AXS Smart X2S (crystal-to-structure for small molecule system), Silver: NLISIS Meltfit One (chromatography), Bronze: Bruker AXS X2 Picofox (TXRF spectrometer).

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For additional news about X-ray analysis and other spectroscopy sciences, please browse the Wiley website. http://www.SpectroscopyNow.com

Kenji Sakurai
News Editor
sakurai@yuhgiri.nims.go.jp
or sakurai@pas.tsukuba.ac.jp

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X-RAY SPECTROMETRY
X-Ray Spectrom. 2008; **37**: 470–471

NEWS

SCIENCES

Further analysis of silica on Mars (May 23, 2008)

In May 2007, NASA's Mars rover Spirit found that Martian soil has a high concentration of silica. This is considered as very strong evidence that water could have existed on ancient Mars, because certain hydrothermal reactions are most likely to produce silica. The discovery was announced in brief at the time (see http://www.nasa.gov/mission_pages/mer/mer-20070521.html), but scientists led by Professor S. Squyres (Cornell University, United States) have now had time to fully analyze the mineral deposits. In addition to the Miniature Thermal Emission Spectrometer (Mini-TES), the Alpha Particle X-ray Spectrometer (APXS) contributed significantly to the analysis. Analysis of the elemental composition of the deposits revealed that Si is strongly enriched relative to typical soil, and there are weaker enrichments in Ti, Cr, and Zn. Other major elements appear to be depleted. For more information, see the paper, *"Detection of Silica-Rich Deposits on Mars"*, S. W. Squyres et al., Science, 320, 1063 (2008).

Soft X-ray microscope observation of spin-torque-induced vortex gyration (April 30, 2008)

Spintronics is now one of the most important keywords in modern sciences and technologies. The currently employed method for magnetic recording uses electrical current pulses, and there appear to be limitations for extremely high density devices (e.g., G-bit level MRAM). One of the most promising solutions is the use of spin polarized current in a ferromagnetic medium, which can provide a spin-transfer torque to the magnetization, resulting in its motion. To develop high-density and very fast devices, it is indispensable to obtain a fundamental understanding of what really takes place there. Recently, a research group led by Dr. G. Meier (Hamburg University, Germany) succeeded in visualizing spin-torque-induced vortex gyration in micrometer-sized permalloy squares using a 30nm-resolution X-ray microscope at the Advanced Light Source (ALS), Berkeley, United States. The phases of the gyration in structures with different chirality have been analyzed considering alternating spin-polarized currents and the current's Oersted field. For more information on the present experiments, see the paper, *"Time-Resolved X-Ray Microscopy of Spin-Torque-Induced Magnetic Vortex Gyration"*, M. Bolte et al., Phys. Rev. Lett., 100, 1701 (2008).

XRD tomography (April 20, 2008)

Progress in nano sciences requires further development of local structural probes, particularly for the study of non-uniform materials. As material functions are often concerned with heterogeneity and some hierarchical orders of the structures, some kind of zooming from low to high resolution will become crucial in the future. Furthermore, in addition to two-dimensional (2D) imaging of an object with a lateral resolution determined by the beam size, some depth resolution is important for a better understanding of materials. So far, X-ray techniques have had several limitations with respect to such points. Recently, French scientists led by Professor J-L. Hodeau (CNRS, Grenoble, France) have reported an interesting development. They are trying to combine pencil-beam tomography with X-ray diffraction to examine unidentified phases in nanomaterials and polycrystalline materials. The experiments were for a high-pressure pellet containing several carbon phases and a heterogeneous powder containing chalcedony and iron pigments. For more information, see the paper, *"Probing the structure of heterogeneous diluted materials by diffraction tomography"*, P. Bleuet et al., Nature Materials, 7, 468 (2008).

New way to distinguish chirality by X-ray diffraction (April 8, 2008)

X-ray Bragg diffraction can determine crystal structures. So far, however, distinguishing between right- and left-handed crystals has not been done by ordinary X-ray diffraction. Japanese scientists led by Professor S. Shin (RIKEN & The University of Tokyo) recently succeeded in revealing the chirality of crystals by measuring Bragg diffraction near the absorption edge, using circular polarization of synchrotron X-rays at the SPring-8. Reflections only allowed at resonant conditions have been well interpreted for the α-quartz case. For more information, see the paper, *"Right Handed or Left Handed? Forbidden X-Ray Diffraction Reveals Chirality"*, Y. Tanaka et al., Phys. Rev. Lett., 100, 145502 (2008).

The next undulator source to look at orbital angular moment (March 24, 2008)

It is known that a helical undulator does not generate any higher-order harmonics on the central radiation axis. As such, off-axis radiation in higher-order harmonics has been considered useless, but so far this problem has not been discussed further. Professor S. Sasaki and his colleagues (Argonne National Lab, USA) have recently published an interesting paper about this problem. They found that all the harmonics except the fundamental from a variable polarizing undulator, such as an Advanced Planar Polarized Light Emitter (APPLE) device, are expressed by Laguerre-Gaussian modes carrying orbital angular momentum, when it is phased to deliver circularly polarized radiation. As the advent of polarized X-ray sources has dramatically expanded the understanding of magnetism, the availability of intense X-ray beams carrying orbital in addition to spin angular momentum could open the door to new condensed matter research via X-ray scattering and spectroscopy methods. For more information, see the paper, *"Proposal for Generating Brilliant X-Ray Beams Carrying Orbital Angular Momentum"*, S. Sasaki et al., Phys. Rev. Lett., 100, 124801 (2008).

PROFESSIONAL

X-ray reflectivity schools in Japan and France (May 8, 2008)

There appears to be increasing demand for learning analytical techniques for surfaces and interfaces. In Japan, the 2nd tutorial course on the analysis of thin films and multilayers by X-ray reflectivity was held on March 26. Although a similar school was run only 4 months earlier, an additional 50 young participants came to Tsukuba for the course. In France, the 3rd school was held at Giens on May 4-8. The organizers were Professors A. Gibaud (Université du. Maine), R. Lazzari (Institut des NanoSciences de Paris) and J. Daillant (Institut Rayonnement Matière de Saclay). Of particular note is that SAXS, GI-SAXS and In-plane XRD have been newly included in the program, in addition to ordinary X-ray reflectivity. Further information is available at http://www.nims.go.jp/xray/ref/ (in Japanese only) and http://www.univ-lemans.fr/~gibaud/ecoledegiens/ (in French only), respectively.

Japanese decorations for spring 2008 (April 29, 2008)

The Japanese government has released the list of recipients of this year's spring decorations, comprising 3,973 Japanese and 51 foreign nationals, for their contributions to the nation and public in politics, business, culture and the arts. Readers of *X-Ray Spectrometry* would be interested to know that Sir Martin Wood, one of the founders of Oxford Instruments, received The Order of the Rising Sun, Gold Rays with Neck Ribbon. An official explanation of Japanese decorations and medals can be found at http://www8.cao.go.jp/english/decoration/index.html Wikipedia carries a comprehensive introduction at http://en.wikipedia.org/wiki/Order_of_the_Rising_Sun

JAAS issue devoted to synchrotron radiation (March 10, 2008)

Issue 6, vol. 23 (2008) of the Journal of Analytical Atomic Spectroscopy (JAAS) is devoted to the theme of synchrotron

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radiation. As guest editors, Professors A. von Bohlen and M. Tolan (Technische Universitat Dortmund, Germany) compiled 1 critical review and 7 regular papers. The title and the first authors are as follows: *"Synchrotron radiation induced TXRF"*, C. Streli et al., 792, *"Synchrotron radiation and cultural heritage: combined XANES/XRF study at Mn K-edge of blue, grey or black coloured palaeontological and archaeological bone material"*, I. Reiche et al., 799, *"The barium giant dipole resonance in barite: a study of soft X-ray absorption edges using hard X-rays"*, C. Sternemann et al., 807, *"Non-destructive, depth resolved investigation of corrosion layers of historical glass objects by 3D Micro X-ray fluorescence analysis"*, B. Kanngieser et al., 814, *"Applications of synchrotron-based micro-imaging techniques to the chemical analysis of ancient paintings"*, M. Cotte et al., 820, *"A combination of synchrotron and laboratory X-ray techniques for studying tissue-specific trace level metal distributions in Daphnia magna"*, B. De Samber et al., 829, *"Sodium sulfate heptahydrate: a synchrotron energy-dispersive diffraction study of an elusive metastable hydrated salt"*, A. Hamilton et al., 840, *"Reference-free X-ray spectrometry based on metrology using synchrotron radiation"*, B. Beckhoff, 845. In the editorial column, the editors point out some very interesting facts on the number of publications in the field of synchrotron radiation applications. They investigated the ISI Web of Science database and found that 1991 was a critical year. The relevant Figure shows a big jump in the number of publications, somewhat resembling an absorption edge. This jump no doubt correlates to the several year delayed big pulses, i.e., the advent of the 3rd generation sources, ESRF (1994), APS (1996) and SPring-8 (1997).

NEW PRODUCTS

PANalytical unveils new petrochemical standard sets for XRF (May 21, 2008)

PANalytical (Almelo, The Netherlands) has introduced a series of new petrochemical standard sets for X-ray fluorescence (XRF). The standard sets are made by VHG Labs, and are available for: wear metals, lubrication oils, sulfur in diesel fuel and sulfur in oil. They contain standards in 50 ml bottles, consumables, a calibration template and a performance testing sample for independent verification of the calibration. For further information, visit the web page, http://www.panalytical.com/

EDAX launches APOLLO XV SDD (May 1, 2008)

EDAX Inc., has launched the Apollo XV SDD, the latest generation of silicon drift detectors for X-ray microanalysis. The energy resolution is 128eV and 52eV, at around Mn and C Kα X-ray energy, respectively. EDAX is a unit of AMETEK Materials Analysis Division. For further information, Phone:+1-(201)529-4880, Fax:+1-(201)529-3156, E-mail: info.edax@ametek.com, http://www.edax.com/

Bruker releases TOPAS V4 software (April 8, 2008)

Bruker AXS GmbH recently released its TOPAS V4 software for structure analysis. The main features supported are (i) the Charge Flipping method for ab-initio structure determination (Oszlanyi & Suto, 2004; Coelho, 2007), (ii) 3D Fourier maps for completion of partial structure models, and (iii) Variable Counting Time (VCT) data, taking advantage of the best possible data quality achievable. For quantitative phase analysis, the PONKCS method (Scarlett & Madsen, 2006) is fully supported, allowing the accurate quantification of compounds, where the classic Rietveld method fails. For further information, visit the following page, http://www.bruker-axs.de/

CORPORATE

Oxford acquires Link Analytical (May 28, 2008)

Oxford Instruments plc has announced the acquisition of the business and assets of Link Analytical AB from Anna Otterstrom, the current owner. Link's primary activity is the distribution and after-sales support of Oxford Instruments NanoAnalysis equipment in Scandinavia. For further information, contact Jonathan Flint or Kevin Boyd, Phone: +44-1865 393 200, or visit the web page, http://www.oxford-instruments.com/

Spectro opens Japanese office and demonstration facility (May 20, 2008)

Spectro Analytical Instruments has opened an instrument demonstration and application laboratory along with a direct sales, service and marketing office in Tokyo near Shinagawa station; address, Shinagawa NSS Bldg, 13-31 Kohnan 2-chome Minato-ku, Tokyo 108-0075, Phone: +81-3-37405172, Fax: +81-3-37405307. In addition, SPECTRO and EDAX operate a joint sales and marketing office in Osaka, Japan; address, Shin-Osaka Yachiyo Bldg., 1-45, Miyahara 4-chome, Yodogawa-ku, Osaka 532-003, Phone: +81-6-63503815, Fax: +81-6-63503825. For further information, visit the web page, http://www.ametek.com/

PANalytical announces new training course program (April 30, 2008)

PANalytical (Almelo, The Netherlands) has announced details of more than 50 training courses for both introductory and in-depth training, covering all areas of X-ray diffraction (XRD) and X-ray fluorescence (XRF) spectroscopy. The program is delivered at PANalytical centers around the world. For further information, visit the web page, http://www.panalytical.com/

Rigaku wins award at the ELRIG protein crystallography conference (April 21, 2008)

Rigaku Americas Corporation announced the receipt of the "Most Innovative New Technology" award for the Desktop Minstrel UV, an ultraviolet crystal imaging and analysis system, and CrystalMation, an automated crystallization system, at the European Laboratory Robotics Interest Group (ELRIG) protein crystallography conference, held in Cambridge, U.K. on April 1, 2008. For further information, contact Craig Sterling, Phone: +1-760 438 5282 Ext 129, E-mail: craig.sterling@rigaku.com, or visit the web page, http://www.rigaku.com/

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Kenji Sakurai
News Editor
sakurai@yuhgiri.nims.go.jp
or sakurai@pas.tsukuba.ac.jp

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X-Ray Spectrom. 2008; **37**: 566–567

NEWS

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Synchrotron XRF revealed Van Gogh's hidden painting (July 29, 2008)

It is well-known that Vincent van Gogh (1853–1890) often reused canvases and painted over his older works. Specialists estimate that about one third of his early paintings conceal other compositions under them. Recently, an international team led by Professor K. Janssens (University of Antwerp, Belgium) and Dr J. Dik (Delft University of Technology, The Netherlands) successfully applied synchrotron radiation induced X-ray fluorescence spectroscopy to the painting entitled Patch of Grass (painted by Van Gogh in Paris in 1887 and owned by the Kroller-Muller Museum). The research group recorded X-ray fluorescence intensity maps of several tens of square cm and, in particular, the distribution of Hg and Sb, which corresponds to red and light tones, respectively. In this way, it could analyze an approximate color reconstruction of the flesh tones. Accordingly, a portrait of a woman was discovered behind the painting. The measurement was done at DESY in Hamburg, Germany. For more information, visit the Website, http://www.vangogh.ua.ac.be/, and see the paper, *"Visualization of a Lost Painting by Vincent van Gogh Using Synchrotron Radiation Based X-ray Fluorescence Elemental Mapping"*, J. Dik *et al.*, Anal. Chem., ASAP Article, 10.1021/ac800965g (2008).

High-resolution microscopy - marriage of lenseless imaging and X-ray nano beam technology (July 18, 2008)

Scanning diffraction microscopy, or ptychography, was first developed for the scanning transmission electron microscope (STEM). In the same way, by using an X-ray nano beam, one can use a STXM. The X-ray beam is focused onto the sample via a lens, and the transmission is measured. The image is obtained by plotting the transmission as a function of the sample position, as it is rastered across the beam. The analysis is straightforward, but its resolution is limited by the beam size. On the other hand, coherent diffractive imaging (CDI) now reaches resolutions below 10 nm, but the reconstruction procedures are not always easy due to the influences of data quality, sample conditions etc. A Swiss research group led by Drs. C. David and F. Pfeiffer (Paul Scherrer Institut) recently demonstrated a ptychographic imaging method that bridges the gap between STXM and CDI by measuring complete diffraction patterns at each point of a STXM scan. The group employed an advanced large-area pixel detector, Pilatus, to obtain the diffraction pattern efficiently. These diffraction data were then treated with an image reconstruction algorithm developed by the team. Several tens of thousands of diffraction images were processed to obtain one super-resolution X-ray image. The algorithm not only reconstructs the sample but also the exact shape of the light probe resulting from the X-ray beam. The 6.8 keV X-ray beam was focused using a zone plate, and the beam size was 300 nm. The spatial resolution achieved was about five times higher. For more information, see the paper, *"High-Resolution Scanning X-ray Diffraction Microscopy"*, P. Thibault *et al.*, Science, **321,** 379–382 (2008).

3D XRD imaging of corrosion in steel (July 18, 2008)

The corrosion of steel-based mechanical components is said to be responsible for the loss of about 3% of annual global GDP. Cracks can appear in stainless steel components when stress or strain is combined with a corrosive environment that attacks sensitive grain boundaries. In nuclear power plants, certain grain boundaries can become sensitive during heat treatments or during fast neutron irradiation. It is important to observe how these cracks grow in detail, because they have been identified as the primary cause of several critical system failures. At the European Synchrotron Radiation Facility (ESRF), Grenoble, France, Dr. A. King and his colleagues recently revealed how growing cracks interact with the 3D crystal structure of stainless steel. The sample was a wire of 0.4 mm in diameter, and 40 keV X-rays were employed. By using diffraction contrast tomography, the research group could observe the shapes, positions, and orientations of 362 different grains with some 1600 grain boundaries without destroying the sample. They put the wire into a corrosive liquid, $K_2S_4O_6$, and applied a load to cause microcracks to grow between the grains. As the cracks grew, 3D tomographic scans (of 30 minutes each) were made at intervals of between several minutes and two hours to follow the progress of the cracks. It was found that the cracks grew along the boundaries between the grains. The technique has enabled visualization of the cracks as they grow and of certain special boundaries that resist cracking. Information on this method is given in the following papers; "X-ray diffraction contrast tomography: a novel technique for three-dimensional grain mapping of polycrystals. I. Direct beam case", W. Ludwig *et al.*, J. Appl. Crystallogr. 41, 302 (2008) and "II. The combined case", G. Johnson *et al.*, J. Appl. Crystallogr. 41, 310 (2008). For more information on the present research, see the paper, *"Observations of Intergranular Stress Corrosion Cracking in a Grain-Mapped Polycrystal"*, A. King *et al.*, Science, **321,** 382–385 (2008).

X-ray spectroscopy under the bormann transmission condition (July 10, 2008)

When X-rays satisfy Bragg's law for a perfect crystal, a significant transparency to X-ray beams is observed. This is the so-called Bormann effect, and is caused because the X-ray electric field approaches zero amplitude at the crystal planes, corresponding to almost no scattering by atoms. Recently, Dr. S. P. Collins (Diamond Light Source, United Kingdom) and his colleagues attempted several very interesting experiments—X-ray spectroscopy under the Bormann transmission condition. The main idea is that the electric quadrupole absorption transitions could be effectively enhanced under conditions of absorption suppression. The measured sample is gadolinium gallium garnet ($Gd_3Ga_5O_{12}$) cut parallel to the (100) planes, and some new spectral features were observed in the L_I (8,376 eV), L_{II} (7,930 eV) and L_{III} (7,243 eV) edges for gadolinium, at different temperatures. They are basically additional peaks on the low energy side, and correspond to an electric quadrupole transition from 2s, $2p_{1/2}$ and $2p_{2/3}$ to the narrow, half-filled 4f states, respectively. For more information, see the paper, *"Quadrupole transitions revealed by Borrmann spectroscopy"*, R. F. Pettifer *et al.*, Nature, **454,** 196–199 (2008).

Analysis of hyper-accumulating plants (July 9, 2008)

Recently, Professor I. Nakai (Tokyo University of Science, Japan) and his colleagues published a very interesting report on synchrotron X-ray fluorescence analysis of the cadmium hyper-accumulating plant, Arabidopsis halleri ssp. gemmifera. To investigate the Cd accumulation mechanism, they analyzed the spatial distribution and chemical form of Cd at a cellular level. At Japanese synchrotron facility, SPring-8, a tiny beam of $3.8 \times 1.3\ \mu m^2$ with 37 keV X-rays was used to see Cd K X-rays. For more information, see the paper, *"Micro X-ray fluorescence imaging and micro X-ray absorption spectroscopy of cadmium hyper-accumulating plant, Arabidopsis halleri ssp. gemmifera, using high-energy synchrotron radiation"*, N. Fukuda *et al.*, J. Anal. At. Spectrom., **23,** 1068–1075 (2008).

A future X-ray source - FEL oscillator with ERL and optical cavity (June 17, 2008)

Recently, Professor K.-J. Kim (Argonne National Lab., USA) and his colleagues published a very interesting proposal for the world's brightest X-ray source. In most currently on-going X-ray free electron laser (FEL) projects, self-amplified spontaneous emission (SASE) is employed. It is known that SASE-FEL creates extremely brilliant, coherent X-ray pulses of 0.1 ps duration. Due to the low repetition rate, the average brightness is only about 10,000 times compared with existing 3rd generation synchrotron sources. On the other hand, future X-ray sciences will require other types of X-ray laser source, with an even smaller number of photons in one pulse (to reduce radiation damage to the sample) and with much greater average intensity via a high repetition rate. In Professor Kim's X-ray source based on a FEL oscillator (X-FELO), a pulse of electrons is carried into an undulator as ordinary FEL, but in order to reflect back the generated X-rays into the undulator entrance, there is an optical cavity consisting of two or more Bragg reflectors with low-Z atoms and with low Debye temperature, such as diamond, beryllium oxide and sapphire crystals. In the next step, the X-ray photons connect with the next electron bunch and again travel back along the undulator. This pattern is repeated indefinitely with the X-ray intensity growing each time until equilibrium is reached. As the spectral bandwidth is extremely narrow, at three to four orders of magnitude finer than those produced by SASE-FEL, the intensity of an individual X-ray pulse from an X-FELO is rather low. But the average X-ray intensity is higher than that of SASE-FEL. Over the past 5 years, highly advanced electron beam technologies, which can

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be used, for example, for a multi-GeV class energy recovery linac (ERL), have become available. One of the key elements of Professor Kim's idea is combination with ERL. This is predicted to produce X-ray pulses with 10^9 photons at a repetition rate of 1–100 MHz. The pulses are temporarily and transversely coherent, with a rms bandwidth of about 2 meV, and rms pulse length of about 1 ps. To gain an understanding of the original concept of X-FELO, see the paper, *"Proposal for a free electron laser in the X-ray region"*, R. Colella and A. Luccio, *Optical Commun.*, **50**, 41–44 (1984). For more information on the proposed X-ray source, see the paper, *"A Proposal for an X-Ray Free-Electron Laser Oscillator with an Energy-Recovery Linac"*, K.-J. Kim *et al.*, *Phys. Rev. Lett.*, **100**, 244802 (2008).

High-resolution soft X-ray spectroscopy revives RÖNtgen's water structure model (June 11, 2008)

The molecular structure of liquid water has been the subject of intense debate for decades. In 1892, German physicist W. C. Röntgen, who became famous for his discovery of X-rays, published a paper proposing a "mixture model" according to which liquid water consists of two kinds of molecules: a tetrahedral ice-like structure, and another more loosely arranged structure. In 1933, J. D. Bernal and R. H. Fowler successfully analyzed early X-ray diffraction data on water in terms of a disordered quartz-like structure, and concluded that the unique properties of water are due to the tetrahedral geometry. Since then, a number of experimental and theoretical studies have been published. Nevertheless, scientists have not yet captured a clear picture of liquid water. The debate is far from settled. Very recently, an international collaborative team led by Dr. A. Nilsson (Stanford Synchrotron Radiation Laboratory) and Professor S. Shin (RIKEN & The University of Tokyo) succeeded in obtaining X-ray spectroscopic evidence to support Röntgen's mixture model. Thanks to the brilliant synchrotron beamline at the SPring-8, the research group obtained some high resolution oxygen K-edge X-ray emission spectra of liquid water. The team found that there are two distinct narrow lone-pair derived peaks assigned, respectively, to tetrahedral and strongly distorted hydrogen-bonded species. For more information, see the paper, *"High resolution X-ray emission spectroscopy of liquid water: The observation of two structural motifs"*, T. Tokushima *et al.*, Chem. Phys. Lett., **460**, 387–400 (2008).

PROFESSIONAL

Helmholtz Humboldt Research Award 2008 (June 26, 2008)

The Helmholtz Association and the Humboldt Foundation have announced the 2008 recipients of the Helmholtz Humboldt Research Award; Professors Roberto Bassi (Universita degli Studi di Verona, Italy) and Shigemasa Suga (Osaka University, Japan). The award amounts to 60,000 Euros, and an additional amount of 25,000 Euros is made available by the Helmholtz Association if the awardee accepts the invitation to undertake research in Germany. In the X-ray field, in addition to this year's award winner Professor Suga, Professors Charles S. Fadley and Ian Robinson were previous recipients of this award. For more information, visit the Web page, http://www.helmholtz.de/en/research/research_awards/helmholtz_humboldt_research_award/

Recent review article on compact laser-plasma accelerators (June 1, 2008)

Advanced high-intensity laser systems can be used to drive electrons to velocities close to the speed of light. A fair degree of research is now being devoted to the generation of high-energy beams that are extremely brilliant, ultra-short pulses, and have excellent spatial quality as well. The following recently published review paper is useful for those wishing to ascertain the current status of research. "Principles and applications of compact laser-plasma accelerators", V. Malka *et al.*, Nature Physics 4, 447–453 (2008).

NEW PRODUCTS

Thermo Fisher Scientific announces new OES and XRF automation software (July 18, 2008)

Thermo Fisher Scientific Inc. has announced the introduction of the Thermo Scientific ARL SMS version 6, a common software platform covering both Optical Emission (OES) and X-Ray Fluorescence (XRF) spectrometers and an automation solution. For further information, Phone: +1-800-532-4752, analyze@thermofisher.com or visit the Web page, http://www.thermo.com/xray/

Rigaku introduces the RAPID II curved detector XRD system (June 26, 2008)

Rigaku Americas Corporation has announced the introduction of the latest version of a new large area curved imaging plate (IP) detector, the RAPID II. Typical applications are high-resolution charge density measurement, micro-diffraction, diffuse scattering, measurement of weakly diffracting disordered materials, small molecule crystallography, wide angle X-ray scattering (WAXS), stress and texture measurements, as well as general purpose powder diffraction. For further information, contact Thomas F. McNulty, Phone: +1-281-362-2300 Ext207, tom.mcnulty@rigaku.com, or visit the Web page, http://www.rigaku.com/

SII Nanotechnology's new XRF analyzer with high-speed mapping capability (June 17, 2008)

SII NanoTechnology Inc. has released the SEA6000VX, an energy dispersive fluorescent X-ray analyzer. In addition to quantitative analysis of trace metals (-1000 ppm) in a relatively small area (0.5–1.2 mm dia.), it can provide a map of each element by quick 2D scan. The detector works at a high counting rate and does not require liquid nitrogen. The price will be around 18,000,000 JPY. For further information, visit the Web page, http://www.siint.com/en/index.shtml

PANalytical launches SuperQ thin film and solar cell analysis solutions (June 9, 2008)

PANalytical has released its new SuperQ 4.0 software, which provides solutions for thin films analysis by X-ray fluorescence (XRF). For further information, visit the web page, http://www.panalytical.com/

CORPORATE

PANalytical and Malvern open U.S. office (July 7, 2008)

The PANalytical and Malvern Instruments U.S. teams have announced that they celebrated the opening of their new headquarters on May 23, 2008. Their address is as follows: 117 Flanders Road WESTBOROUGH MA 01581 USA, Phone: +1-508-6471100, Fax: +1-508-6471115 (PANalytical), Phone: +1-508-7686400, Fax: +1-508-7686403, info@malvernusa.com (Malvern). For further information, visit the web pages, http://www.panalytical.com/and http://www.malvern.co.uk/

Rigaku forms new company in europe (June 9, 2008)

Rigaku Corporation has announced the formation of Rigaku Innovative Technologies Europe s.r.o. (RITE) in Prague, Czech Republic. For further information, contact, John C. McGill, Managing Director, Address: Novodvorska 994, 142 21 Prague 4, Czech Republic, john.mcgill@Rigaku.com, or visit the web page, http://www.rigaku.com/

Jordan Valley Acquires Bede Metrology (April 14, 2008)

Jordan Valley Semiconductors Ltd and Jordan Valley Semiconductors UK Ltd have acquired the business of Bede PLC and Bede Scientific Instruments Ltd. Bede was founded in 1978 as a spinout company from England's University of Durham. It has been listed on the London stock exchange (LSE: BED) since 2000. For further information, contact Meir Mimon, Jordan Valley Semiconductors Ltd, Phone: +972-4-6543666, meirm@jordanvalley.com, or visit the web page, http://www.jvsemi.com/

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Kenji Sakurai

News Editor
sakurai@yuhgiri.nims.go.jp
or sakurai@pas.tsukuba.ac.jp

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NEWS

SCIENCES

Tracking the structural dynamics of human hemoglobin with nsec time resolution (September 21, 2008)

Professor A. Cupane (University of Palermo, Italy) and his colleagues at the European Synchrotron Radiation Facility (ESRF) recently established a method for structural dynamics. The technique uses wide-angle X-ray scattering and images proteins in their natural, fast-moving state. The research group succeeded in capturing the tertiary and quaternary conformational changes of human hemoglobin in close to physiological conditions triggered by laser-induced ligand photolysis. The time resolution of the observation is in the order of nsec. The whole process lasts 3μsec, and the molecule changes from a "relaxed" form that can bond to oxygen, to a "tense" form that squeezes out the oxygen. They also reported data on optically induced tertiary relaxations of myoglobin and refolding of cytochrome c. For more information, see the paper, *"Tracking the structural dynamics of proteins in solution using time-resolved wide-angle X-ray scattering"*, M. Cammarata *et al.*, Nature Methods, published online, 21 September 2008, doi:10.1038/nmeth.1255

X-ray detection of shape changes of catalytic nanoparticles (September 19, 2008)

It is well known that nanoparticles often enhance catalytic activity. However, it is still an open question as to whether the metallic or the oxidized state of the particle is the catalytically more active phase. It is therefore significant to study the oxidation/reduction process of metallic nanoparticles. A group led by Professor H. Dosh (Max-Planck-Institut für Metallforschung, Germany) recently reported on some very interesting XRD and GISAXS studies on the oxygen-induced shape transformation of Rh nanoparticles. The experiments were done in-situ, during the oxidation/reduction cycle at high temperature. The group found that shape transformation is driven by the formation of a surface oxide O-Rh-O trilayer, which can stabilize Rh nanoparticles with low-index facets. For more information, see the paper, *"Shape Changes of Supported Rh Nanoparticles During Oxidation and Reduction Cycles"*, P. Nolte *et al.*, Science, **321**, 1654–1658 (2008).

The highest spatial resolution in hard X-ray microscopy -5nm — has been achieved with 100 nm beam size (August 29, 2008)

X-ray microscopy is continuing to make significant progress in two directions, through the use of advanced X-ray optical elements and through the combined use of coherent X-rays and image analysis. Currently, the typical spatial resolution available at major synchrotron radiation facilities is the order of tens of nm. Professor C. Schroer (Technische Universität Dresden, Germany) and his colleagues recently achieved the world record for spatial resolution in X-ray microscopy. The research group employed the coherent x-ray diffraction imaging technique and observed a single gold nanoparticle (size<100 nm) supported by a Si_3N_4 membrane with 15.25 keV photons, beam dimensions 100 × 100 nm^2, and flux of more than 1E+8 counts/sec. The real-space gold image was reconstructed by the hybrid input-output (HIO) method together with the shrink-wrap algorithm. The resolution of 5 nm was achieved in 600 s exposure time. The present experiments were done at beamline ID13, ESRF, and a pair of refractive lenses was used to increase the coherent dose density. For more information, see the paper, *"Coherent X-Ray Diffraction Imaging with Nanofocused Illumination"*, C. G. Schroer *et al.*, Phys. Rev. Lett., **101**, 090801 (2008).

Structure of SAM on Au(111) (August 15, 2008)

Some of the most well known self-assembled monolayers (SAMs) are alkyl sulfides on gold surfaces. They have many potential applications in molecular electronics, biosensors, and nanopatterning. However, there have still been unsolved problems in basic research regarding Au-S interaction. Recently, Professor A. Morgante (Universita' di Trieste, Italy) and his colleagues published the results of grazing incidence X-ray diffraction and density functional theory-based molecular dynamics simulations for hexanethiol and methylthiol. The research group demonstrated surface complexes wherein two S atoms are joined by an intermediate Au adatom (RS-Au-SR) for longer chain cases. It was found that the sulfur atoms of the molecules bind at two distinct surface sites, and that the first surface layer contains vacancies as well as gold adatoms that are laterally bound to two sulfur atoms. Competition between SAM ordering and disordering of interfacial Au atoms takes an important role in the system. For more information, see the paper, *"X-ray Diffraction and Computation Yield the Structure of Alkanethiols on Gold(111)"*, A. Cossaro *et al.*, Science, **321**, 943–946 (2008).

3D X-Ray image of Ta_2O_5 nanofoams (July 28, 2008)

Aerogel is a form of nanofoam, an engineered material designed for its high strength-to-weight ratio for application wherever lightness and strength are needed. Now, the internal structure is within the scope of X-ray analysis. Lawrence Livermore and Lawrence Berkeley scientists have successfully applied the coherent X-ray diffraction technique to Ta_2O_5 nanofoam, the density of which is 1.2% to the bulk, and have reconstructed 3D images to determine its strength and potential new applications. Combining the obtained structural information with detailed simulations, the research team showed that the blob-and-beam network structure explains why the materials are weaker than expected. For more information, see the paper, *"Three-Dimensional Coherent X-Ray Diffraction Imaging of a Ceramic Nanofoam: Determination of Structural Deformation Mechanisms"*, A. Barty *et al.*, Phys. Rev. Lett., **101**, 055501 (2008).

X-ray standing wave determines Al occupancy in zeolite (June 22, 2008)

Zeolites are microporous crystalline materials, and in the unit cell, the tetrahedrally coordinated Si and Al atoms occupy the so-called crystallographic T-sites. In addition to their pore size, Al's occupancy in the specific T-sites is extremely important in catalytic activity. So far, however, the distribution of Al has remained an unresolved problem. Recently, Professor J. A. van Bokhoven (ETH Zurich, Switzerland) and his colleagues employed the X-ray standing wave technique to study Al distribution in scolecite ($CaAl_2Si_3O_{10}$-$3H_2O$, hydrated calcium aluminum silicate). They measured the intensity of X-ray fluorescence, Al K, Si K and Ca Kα near the Bragg conditions of (040), (002) and (−402) reflections. The experiments were done at beamline ID32, ESRF. For more information, see the paper, *"Determining the aluminium occupancy on the active T-sites in zeolites using X-ray standing waves"*, J. A. van Bokhoven *et al.*, Nature Materials, **7**, 551–555 (2008).

PROFESSIONAL

Recent successful commissioning of high-power mode at J-PARC 3-Gev rapid cycling synchrotron (September 19, 2008)

The J-PARC (Japan Proton Accelerator Research Complex, Tokai, Japan) is a new facility with MW-class high power proton beams at both 3 GeV and 50 GeV. At the end of May 2008, the first neutron was produced successfully by proton-beam induced spallation reaction at the Materials and Life Science Experimental Facility (MLF). Furthermore, very recently, the facility succeeded in commissioning high-power operation. Its 3-GeV rapid cycling synchrotron (RCS) is said to have achieved a beam power of 210 kW for a period of 70 seconds at 25Hz, and 315kW-equivalent power in one-pulse operation. For more information, visit the Web page, http://j-parc.jp/index-e.html

Brookhaven synchrotron catalysis consortium receives 3-year funding renewal (August 12, 2008)

At Brookhaven, USA, the synchrotron catalysis consortium (SCC) promotes the utilization of synchrotron techniques to perform cutting-edge catalysis nanoscience research. The activities include dedicated beam time for X-ray absorption spectroscopy experiments at beamlines X18B and X19A at the National Synchrotron Light Source, the assistance of research staff in the set-up of experiments and data analysis, training courses and help sessions etc. Recently, the U.S. Department of Energy has decided to renew a three-year, $1 million grant. For more information, visit the Web page, http://www.nsls.bnl.gov/newsroom/news/

Denver X-ray conference awards (August 6, 2008)

The following awards were presented during the plenary session of the 57th Annual Denver X-Ray Conference:

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1. The 2008 Birks Award was presented to Professor Rene Van Grieken (the chief editor of *X-Ray Spectrometry* journal), University of Antwerp, Antwerp, Belgium
2. The 2008 Jerome B. Cohen Student Award was presented to Mr. Sterling Cornaby, Cornell University, Ithaca, New York, for work entitled, "Bifocal miniature toroidal shaped X-ray mirrors "
3. The 2008 McMurdie Award was presented to Dr. Jeffrey Dann, Osram Sylvania, Towanda, PA

NEW PRODUCTS

Oxford instruments launches a hand-held XRF analyzer with silicon drift detector (September 22, 2008)

Oxford Instruments has released its new X-MET5100 X-ray fluorescence (XRF) analyzer, which combines a silicon drift detector with a powerful 45kV X-ray tube. The instrument enables light elements such as Mg, Al and Si to be measured without the need for complex vacuum pump or helium tank attachments. For more information, visit the Web page, http://www.oxinst.com/

Panalytical's minipal 4 sulfur adapted to new fuel regulations (August 12, 2008)

European Union (EU) countries are facing the introduction of the new Euro V regulations, with their 10 ppm limit on sulfur in ultra low sulfur diesel (ULSD), in January 2009. Through a series of incentives and local initiatives, many EU countries already comply with the standard. In the US, the EPA (Environmental Protection Agency) has mandated the reduction of sulfur content in ULSD to 15 ppm. All highway diesels must meet this standard by December 2010. PANalytical's compact EDXRF spectrometer - MiniPal 4 Sulfur - has been designed for quality control and for monitoring the sulfur concentration level in diesel fuels. The instrument employs a 15 kV silver anode tube that avoids overlap with sulfur signals, and a new silicon drift detector. For more information, visit the Web page, http://www.panalytical.com/

EDAX releases software for accurate element identification (August 7, 2008)

In X-ray analysis, correct identification of the peaks in the spectrum is indispensable. Most peak identification routines usually use a rules-based algorithm, which at best provides reasonable accuracy. So far, such routines have employed some form of peak simulation to overlay the spectrum to provide a visual confirmation that the peak identification is acceptable. In order to further enhance accuracy in quantitative analysis, EDAX has recently released a new element identification routine, EXpert ID. For more information, visit the Web page, http://www.edax.com/EDAX is a unit of AMETEK Materials Analysis Division.

Bruker unveils first handheld XRF spectrometer (June 25, 2008)

Bruker AXS Handheld Inc. has announced the release of the TRACERturboSD, a handheld X-ray fluorescence instrument that features a silicon drift detector. For further information, visit the web page, http://www.bruker-axs.de/

Rigaku introduces supermini, a high power benchtop WD-XRF spectrometer (May 8, 2008)

Rigaku Americas Corporation has announced the introduction of a high-power benchtop wavelength dispersive X-ray fluorescence (WDXRF) spectrometer system, the Rigaku Supermini. The spectrometer employs an air-cooled 50 kV, 200W tube, three analyzing crystals, two detectors, a 12-position sample changer and a choice of analysis in an air, vacuum or helium (He) atmosphere. For further information, contact Thomas F. McNulty, Phone: +1-281-362-2300 Ext207, tom.mcnulty@rigaku.com, or visit the Web page, http://www.rigaku.com/

CORPORATE

Bruker acquires AFM company, SIS (August 18, 2008)

Bruker AXS has announced that it has signed an agreement to acquire all of the equity of Surface Imaging Systems (SIS), a company with annual revenues of approximately $3 million. The transaction is expected to close in the third quarter of 2008. SIS is located in Herzogenrath, near Aachen, Germany, and has developed atomic force/scanning probe microscopy systems or AFM/SPM, a well-established method for ultra-high spatial resolution surface imaging and characterization of surfaces down to atomic dimensions. SIS will be renamed Bruker Nano GmbH. For further information, contact Michael Willett, Investor Relations and Public Relations Officer, Phone: +1-978- 663–3660, ext. 1411, Michael.Willett@bruker.com or visit the web page, http://www.bruker-axs.de/

Thermo Fisher Scientific acquires FIBERLITE Centrifuge, Inc. (July 28, 2008)

Thermo Fisher Scientific Inc. has announced that it has acquired FIBERLite Centrifuge, Inc., of Santa Clara, California. FIBERLite is a supplier of carbon fiber centrifuge rotors, which are considered as a promising lightweight alternative for traditional metal rotors. For further information, visit the Web page, http://www.thermo.com/

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Kenji Sakurai
News Editor
sakurai@yuhgiri.nims.go.jp
or sakurai@pas.tsukuba.ac.jp

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