X-RAY Spectrometry

(www.interscience.com) DOI 10.1002/xrs.1132

News

Sciences

Nano-scale chemical imaging of working catalyst (November 13, 2008)

Recent progress in synchrotron X-ray microscopy has opened up extremely attractive applications. A group led by Professor B. M. Weckhuysen (Utrecht University, The Netherlands) recently watched heterogeneous catalysts in action at high temperature. Solid catalysts have been widely used in the chemical industry, and accelerate the production of many important compounds. They are typically composed of nanometre-sized metal or metal oxide particles attached to a solid support with a high surface area. As complex structural and chemical changes take place during catalytic reactions, direct observation of the reacting catalyst is extremely important. The team employed X-ray microscopy at the Advanced Light Source, Berkeley, United States, to study the catalytic Fischer-Tropsch reaction where a solid catalyst of iron oxide particles mounted on silica is used to convert carbon monoxide and hydrogen into liquid hydrocarbons that can be used as fuels. By the use of Fe LII, III and C K absorption edges, scanning transmission X-ray imaging has revealed that during the reaction the iron oxide underwent several transformations; the initial iron oxide (Fe_2O_3) is converted into another oxide (Fe_3O_4), before iron silicates (Fe_2SiO_4) and metallic iron begin to form. Iron carbides (Fe_xC_y) appear in the final stage. For more information, see the paper, ''Nanoscale chemical imaging of a working catalyst by scanning transmission X-ray microscopy'', E. de Smit *et al.*, Nature **456,** 222–225 (2008).

Intracellular chemical imaging of human neuromeranin (November 13, 2008)

Neuromeranin (NM) is a dark colored pigment synthesized within specific catecholamine-producing neurons in the human brain. It is of uncertain origin and exists as amorphous granules with a heterogeneous structure called NM granules. At the European Synchrotron Radiation Facility (ESRF) in Grenoble, the microchemical environment of NM in whole neurons from formalin-fixed and paraffin-embedded human substantia nigra sections was recently analyzed. It was found that concentrations of NM-associated elements increase in the developing brain, and that iron-rich microdomains colocalized with other elements within the pigment. Furthermore, intracellular speciation of sulfur in NM has revealed the presence of reduced sulfur compounds and various forms of oxidized sulfur compounds which have not previously been reported. For more information, see the paper, ''Intracellular Chemical Imaging of the Developmental Phases of Human Neuromelanin Using Synchrotron X-ray Microspectroscopy'', S. Bohic *et al.*, Anal. Chem., Article ASAP, DOI: 10.1021/ac801817k

X-ray generation by friction of sticky tape (October 23, 2008)

Professor S. Putterman (University of California, Los Angeles, USA) and his colleagues recently demonstrated that simply peeling ordinary sticky tape in a moderate vacuum can generate sufficient X-rays to take an image of a human finger. The phenomenon has long been known as tribo-luminescence (or mechano-luminescence), but their report (including online video accessible from the Nature News page) has impressed many. Nanosecond, 100-mW X-ray pulses as well as radio and visible light have been clearly confirmed to be correlated with stick-slip peeling events. They observed a 15-keV peak in X-ray energy spectra, and attempted to explain it by various models. For more information, see the paper, *''Correlation between nanosecond X-ray flashes and stick-slip friction in peeling tape''*, C. G. Camara *et al.*, Nature, 455, 1089–1092 (2008), and the news article, ''Sticky tape generates X-rays - How weird is that?'', Katharine Sanderson, Nature News, http://www.nature.com/news/2008/081022/full/news.2008.1185.html as well as readers' comments thereon. A very old and pioneering report describing how peeling tape can be a source of X-rays is ''Investigation of electron emission on tearing away highpolymer film from glass in vacuum'', V. Karasev *et al.*, Doklady Akademii Nauk SSSR, **88,** 777–780 (1953).

Uncertainty in TXRF (October 23, 2008)

Dr. R. Fernandez-Ruiz (Universidad Autonoma de Madrid, Spain) recently published a theoretical paper on the expanded uncertainty associated with TXRF measurements. For more information, see the paper, ''Uncertainty in the Multielemental Quantification by Total-Reflection X-ray Fluorescence: Theoretical and Empirical Approximation'', R. Fernandez-Ruiz, Anal. Chem., **80,** 8372–8381 (2008).

X-ray fluorescence analysis of rocks from other planets (October 15, 2008)

X-ray fluorescence (XRF) spectra for a number of rock samples from Mars, the Moon, and Mercury have been measured at the Physikalisch-Technische Bundesanstalt (PTB) beamline in the BESSY II electron storage ring. In the future, both ESA and NASA will send spacecraft to Mercury. Remote X-ray sensing is planned to obtain chemical composition mapping on the planetary surface. The present synchrotron XRF spectra will be used as valuable reference for the analysis. For more information, see the paper, ''Measuring and Interpreting X-ray Fluorescence from Planetary Surfaces'', A. Owens *et al.*, Anal. Chem., **80,** 8398–8405 (2008).

X-ray spectra of shock compression (October 3, 2008)

A research group at Lawrence Livermore National Laboratory recently reported an interesting application of ultrafast X-ray spectrometry to studies on the compression and heating of shocked matter. Here, the sample is 300 μm thick LiH, which is heated by a 450 J nsec laser, and the X-ray used is Ti Kα X-ray fluorescence (4.51 keV) from Ti foil heated by another pulse laser of 5 psec. X-ray photons produced at the Ti foil are estimated as a 2×10^{13}/pulse. The energy spectra of X-ray scattering by the LiH sample during compression were taken by a spectrometer consisting of a large curved graphite (HOPG) crystal in van Hamos geometry and an Imaging Plate (IP) detector. It was found that the X-ray scattering spectrum from shocked LiH shows elastic Rayleigh scattering and inelastic plasmon scattering features. Whereas earlier in time only elastic scattering was observed, at 7 nsec, a plasmon energy shift of 24 eV was detected. This indicates the transition to metallic free electron plasma in the solid phase. For more information, see the paper, ''Ultrafast X-ray Thomson Scattering of Shock-Compressed Matter'', A. L. Kritcher *et al.*, Science, 322, 69–71 (2008).

X-ray fluorescence analysis of carbon nanotubes in cells (August 2, 2008)

A French research group has reported the application of X-ray fluorescence microscopy to the analysis of macrophages exposed to unpurified and purified single-walled (SW) and multiwalled (MW) carbon nanotubes (CNT). During this research, elemental mapping at cell level was performed for P, Cl, K, Ca and Fe. For more information, see the paper, ''Carbon Nanotubes in Macrophages: Imaging and Chemical Analysis by X-ray Fluorescence Microscopy'', C. Bussy *et al.*, Nano Lett., 8, 2659–2663 (2008).

Professional

A new jobsite for the synchrotron radiation community (November 19, 2008)

A new website dedicated to job offers at synchrotron radiation sources has been started by a joint initiative of the European Synchrotron Radiation

Facility (ESRF) and Institute of Physics (IOP). So far, job seekers have had to regularly scan the websites of many different facilities in the world. The objective of the new website is to cluster as many offers as possible into a single resource. It will also allow those interested to subscribe to weekly mailings of new positions. Visit the following site, http://www.synchrotronjobs.com/

First Indian lunar mission and X-ray spectrometry (October 21, 2008)

Chandrayaan-1 is the Indian Space Research Organisation's (ISRO) mission to the moon, with the main scientific objectives of photo-selenological and chemical mapping of the lunar surface. It was successfully launched from Satish Dhawan Space Centre, Sriharikota on October 22nd, 2008. The total mission is expected to last for two years. One of the most important activities is X-ray measurements by the Chandrayaan-1 X-ray spectrometer (C1XS). The primary goal of the C1XS instrument is to carry out high-quality X-ray spectroscopic mapping of the Moon, in order to constrain solutions to key questions on the origin and evolution of the Moon. C1XS will use X-ray fluorescence spectrometry (1.0–10 keV) to measure the elemental abundance, and map the distribution, of the three main rock-forming elements: Mg, Al and Si. To record the incident solar X-ray flux at the Moon, which is needed to derive absolute lunar elemental surface abundances, C1XS also includes an X-ray Solar Monitor (XSM), which is provided through collaboration between the Rutherford Appleton Laboratory (RAL) and University of Helsinki. With its wide field-of-view of ±52 degrees, XSM provides observation of the solar X-ray spectrum from 1–20 keV with good energy resolution and fast spectral sampling at 16 s intervals. The total mass of C1XS and XSM is 5.2 kg. For more information about Chandrayaan-1, visit the Web page, http://www.isro.org/chandrayaan/htmls/Home.htm Wikipedia gives further info as well, http://en.wikipedia.org/wiki/Chandrayaan-1

The 3rd Asada Award (October 18, 2008)

The joint recipients of the 3rd Asada Award, which is presented in memory of the late Professor Ei-ichi Asada (1924–2005) to promising young scientists in X-ray analysis fields in Japan, are: Dr. Shuji Maeo (Osaka Electro Communication Univ., "Development of multi excitation type X-ray tube") and Dr. Hajime Tanida (Japan Synchrotron Radiation Institute, SPring-8, "Instrumentation on total-reflection XAFS for liquid-liquid interface studies"). The ceremony was held during the 44th Annual Conference on X-Ray Chemical Analysis, Japan, at Japan Women's University, Tokyo.

Shutdown of synchrotron radiation source (SRS) at Daresbury laboratory (August 4, 2008)

The world's first dedicated X-ray synchrotron radiation storage ring, the Synchrotron Radiation Source (SRS), Daresbury, Warrington, in the UK has closed down after 27 years of operation. Since 1980, it has played a key role in enabling and performing cutting-edge research in physics, chemistry and materials science and opened up many new areas of research in fields such as medicine, geological and environmental studies, structural genomics and archaeology. It has hosted over 11,000 users, leading to the publication of more than 5,000 research papers. The baton now passes on to the new Diamond Light Source in Oxfordshire, the UK's direct successor to the SRS. For more information, visit the Web page, http://www.scitech.ac.uk/PMC/PRel/STFC/SRS.aspx Another interesting account by Professor Geaves is found in the following article, "Two million hours of science", G. N. Greaves *et al*., Nature Materials 7, 827–830 (2008).

New Products

PANalytical launches EasySAXS solution for nanoparticle sizing (November 11, 2008)

PANalytical recently released its new solution for small angle X-ray scattering, EasySAXS, which opens up possibilities for the characterization of nanopowders and nano-composite materials. For more information, visit the Web page, http://www.panalytical.com/easysaxs

Thermo Fisher Scientific launches handheld Niton XRF analyzer with large area drift detector (November 10, 2008)

Thermo Fisher Scientific Inc. has announced the Thermo Scientific Niton XL3t Series with geometrically optimized large area drift detector (GOLDD) technology. This new technology delivers improvements in light element detection, overall sensitivity and measurement, making the new analyzer as much as 10 times faster than conventional Si-PIN detectors, and up to 3 times more precise than conventional smaller, silicon drift detectors. It also allows light element detection for Mg, Al, Si, P and S even without He or vacuum purging. For more information, visit the Web page, http://www.niton.com/

e2v introduces industry's first reconfigurable four-channel 10-bit 1.25 Gsps ADC (November 7, 2008)

e2v technologies plc has announced the launch of EV10AQ190, its 10-bit version of the Quad 1.25 Gsps analogue-to-digital converter (ADC). For more information, contact Sylvie Mattei, Phone: +33-4-7658-3025, sylvie.mattei@2v.com or visit the Web page, http://www.e2v.com

PANalytical's new Axios FAST XRF spectrometer (October 14, 2008)

PANalytical has announced the launch of the new Axios FAST, the latest addition to the Axios family of wavelength dispersive XRF spectrometers. Its primary role is to perform high-speed routine XRF measurements for dedicated process control. The system is also fitted with up to four programmable goniometers, which can run simultaneously to give additional flexibility compared to a dedicated fixed channel configuration. For more information, visit the Web page, http://www.panalytical.com/axiosfast

Oxford's X-Max analytical SDD detector (October 13, 2008)

Oxford Instruments has started to supply its new X-Max Silicon Drift Detector (SDD). The X-Max Analytical SDD detector has a large effective area, ranging from 20 mm^2 up to an outstanding 80 mm^2, and achieves an energy resolution down to 123eV with throughput far in excess of 100,000 cps. The solid angle is more than 10 times larger than those of conventional EDS systems for electron microscopes. For more information, visit the Web page, http://www.oxford-instruments.com/Pages/home.aspx

PGT's new SDD, SAHARAIII (September 15, 2008)

Princeton Gamma Tech Instruments (Princeton, NJ) has introduced the SAHARA III, a new Peltier-cooled Silicon Drift Detector which offers users an active detector area of 100 mm^2, with beryllium or low-energy polymer windows. It is a cryogen-free lightweight compact detector system that can achieve low-energy resolutions below 125eV and high count-rates above 100 kps, with a cool down period of less than 2 minutes. For more information, contact Greg Nelson, Phone: +1-609-924-7310, ghn@pgt.com or visit the Web page, http://www.pgt.com/index.html

SPECTRO's new handheld XRF (September 9, 2008)

SPECTRO Analytical Instruments has announced a complete line of mobile and portable metal analyzers; the new SPECTRO xSORT handheld XRF spectrometer, the SPECTRO iSORT portable OES spectrometer and the SPECTROTEST mobile OES spectrometer. The SPECTRO xSORT is a portable X-ray fluorescence instrument for onsite metal analysis. It is equipped with a silicon drift detector, and can determine all of the elements in an alloy in only two seconds. The instrument weighs 1.7 kg. SPECTRO is a member of AMETEK Materials Analysis Division. For more information, contact Tom Milner, Phone: +49-2821-892-0, Fax: +49-2821-892-2200, spectro.info@ametek.com or visit the Web page, http://www.spectro.com/pages/e/index.htm

Corporate

Thermo Fisher Scientific strengthens anatomical pathology portfolio with acquisition of Raymond A. Lamb (November 11, 2008)

Thermo Fisher Scientific Inc. has announced that it has acquired Raymond A. Lamb Ltd., a manufacturer of histology and anatomical pathology products based in Eastbourne, U.K., near London. Raymond A. Lamb had revenues of approximately $9 million in 2007 and will be integrated into Thermo Fisher's Analytical Technologies Segment. For further information, contact Karen Kirkwood, +1-781-622-1306, karen.kirkwood@thermofisher.com or visit the web page, http://www.thermofisher.com

Partnership of e2V and Component Distributors Inc (September 24, 2008)

e2v technologies plc has announced that it has partnered with Component Distributors Inc (CDI) to supply its gas sensors to the north, south and central markets of the Americas. CDI, a high-tech electronics distributor based out of Denver, Colorado, was founded in 1970 and is an employee-owned enterprise. For further information, contact Mike Tarbard, phone: +44-1-245-493493, mike.tarbard@e2v.com or visit the Web page, http://www.e2v.com

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X-RAY Spectrometry

(www.interscience.com) DOI 10.1002/xrs.1162

News

Sciences

Possibility of near diffraction-limit size X-ray beam by higher order harmonic generation (January 11, 2009)

Laser generation in the X-ray region has become realistic because of the construction of free electron laser facilities, which will be available in the near future (Linac Coherent Light Source (LCLS) at Stanford in 2009; European XFEL in 2014). Another significant route is the extension of existing laser technologies such as high-order harmonic generation (HOHG), particularly from relativistically oscillating plasma mirror-like surfaces. Professor M. Zepf (Queens University Belfast, UK) and his colleagues recently published an interesting paper showing that it is possible to achieve a near-diffraction-limited focal spot size that is also controllable. For more information, see the paper, *"Diffraction-limited performance and focusing of high harmonics from relativistic plasmas"*, B. Drome *et al*., Nature Physics, advanced online publication doi:10.1038/nphys1158

A method for realizing sub-angstrom spatial resolution in diffractive imaging of single nanocrystals (December 21, 2008)

Diffractive imaging is a technique for so-called lens-less microscopy, and uses diffraction intensity (image) and phase retrieval calculations rather than focusing systems such as lenses, which are not free from aberrations. The spatial resolution is basically limited only by the amount of high-angle scattering. Therefore, the technique has been considered as having the potential to achieve atomic resolution for hard X-rays or other short-wavelength particle beams. However, so far, the reported results have been still at the level of several nanometers. Recently, a research group at the University of Illinois, USA proposed a method of improving the resolution. One of the biggest technical reasons limiting the spatial resolution of diffractive imaging is the difficulty of recording weak coherent scattering signals. The research group proposes the combined use of low-resolution imaging, which provides the starting phase, real-space constraint, missing information in the central beam and essential marks for aligning the diffraction pattern. The group used an electron microscope to see a single CdS quantum dot with sub-angstrom resolution and noted that it is possible to use the same procedure in the case of coherent X-ray scattering. For more information, see the paper, *"Sub-angstrom-resolution diffractive imaging of single nanocrystals"*, W. J. Huang *et al*., Nature Physics, advanced online publication doi:10.1038/nphys1161

Calculation of Kα spectra for double ionization case (November 10, 2008)

Professor L. Natarajan (University of Mumbai, India) recently published a paper calculating the energies and electric dipole rates of X-rays from the empty K shells of atoms in the range of $Z = 12$ to 56. For more information, see the paper, *"Relativistic fluorescence yields for hollow atoms in the range* $12 < Z < 56$", L. Natarajan, Phys. Rev. **A78,** 052505 (2008).

Further development of inversion technique for the analysis of X-ray and neutron reflectivity data (May 16, 2008)

Analysis of X-ray and neutron reflectivity is usually done by modeling the scattering length density profile (such as multilayers) of the sample and performing a least square fit to the measured, phaseless reflectivity data. Professor T. Salditt (Institute for X-ray Physics, Universitat Gottingen) and his colleague recently attempted to extend the inversion technique. The research group discussed conditions for uniqueness, which are applicable in the kinematic limit (Born approximation), and for the most relevant case of box model profiles with Gaussian roughness. They also demonstrated that an iterative method to reconstruct the profile based on regularization works well. For more information, see the paper, *"Iterative reconstruction of a refractive-index profile from x-ray or neutron reflectivity measurements"*, T. Hohage *et al*., Phys. Rev. **E77,** 051604 (2008).

Modeling of damage dynamics in X-ray free-electron-laser irradiation (April 1, 2008)

As an X-ray free-electron laser (X-FEL) provides extremely strong pulses, it is necessary to understand the photon-induced damage processes for biological samples. A research group led by Dr. Chapman (DESY, Germany and Lawrence Livermore National Lab, USA) has discussed how several aspects of existing continuum damage models can be tested during early operation of X-FEL at lower X-ray energies in the range of 0.8–5 keV and low fluences, focusing particularly on macroscopic collective effects such as particle charging, expansion, and average ionization of nanospheres. For more information, see the paper, *"Modeling of the damage dynamics of nanospheres exposed to x-ray free-electron-laser radiation"*, S. P. Hau-Riege *et al*., Phys. Rev. **E77,** 041902 (2008).

Professional

Two US scientists awarded 2009 Japan Prize (January 15, 2009)

The Science and Technology Foundation of Japan has announced that two US scientists have been named as laureates of the 2009 (25th) Japan Prize. Dr. Dennis L. Meadows, 66, Professor Emeritus of Systems Policy, University of New Hampshire and one of the authors of the report, "The Limits to Growth," for the Club of Rome in 1972, has received the prize in this year's category of "Transformation towards a sustainable society in harmony with nature". Dr. David E. Kuhl, 79, Professor of Radiology, University of Michigan Medical School, was selected in the other prize category of "Technological integration of medical science and engineering". 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, 2009. The prize categories for the 2010 (26th) Japan Prize will be "Industrial Production and Production Technology" and "Biological Production and Environment". For further information, visit the Web page, http://www.japanprize.jp/en/index.html

Department of Energy approves construction of NSLS-II (January 12, 2009)

The U.S. Department of Energy (DOE) has granted "Critical Decision 3" (CD-3) status to the National Synchrotron Light Source II (NSLS-II) at Brookhaven National Laboratory, approving the start of construction in fiscal year (FY) 2009 and scheduling completion in FY 2015. A total project cost for NSLS-II of $912 million has been approved. NSLS-II is expected to be the world's first storage-ring-based synchrotron light source that combines nanometer spatial resolution with high brightness, coherence, and beam stability, enabling nanometer-scale characterization of materials, with powerful applications in nanotechnology and biotechnology. For more information about the NSLS-II project, visit the website at http://www.bnl.gov/nsls2/

Obituary - Eugene P. Bertin (December 2, 2008)

Eugene P. Bertin, author of the most famous XRF textbooks and a very popular instructor in XRF courses, has died at the age of 86, in his apartment in Harrison, NJ, USA. Dr. Bertin was a student at the University of Illinois, in Urbana and received his B.S., M.S., and finally PhD in 1952, in Analytical/Inorganic Chemistry. He worked at the RCA Research Center in Princeton, NJ for many years. Dr. Bertin made many contributions to X-ray spectroscopy. He was the principle lecturer at the "Short summer course in X-ray spectrometry" (organized by Professor Henry Chessin, State University of New York at Albany), and also at ICDD XRF courses. His textbooks, "Principles and Practice of X-Ray Spectrometric Analysis" (Plenum, 1970 (first edition), 1975 (second edition)) and "Introduction to X-Ray Spectrometric Analysis" (Kluwer Academic Pub, 1978) were recognized as the best in the world and were hallmark texts used by thousands of people all over the world. Reviews of these books have been published in X-Ray Spectrometry journal (See, **1,** 45 (1972), **4,** A18 (1975), **8,** v (1979)). Another interesting review is found in J. Appl. Cryst., **5,** 387 (1972). Dr. Bertin was a recipient of the Birks Award at the 1988 Denver Conference. One of his best friends, Dr. V. E. Buhrke has posted an article, "Testimonial and Obituary - in honor of Dr. Eugene P. Bertin, PhD" to the XRF-L mailing list, which can be also read at (http://listserv.syr.edu/scripts/wa.exe?A2=ind0812&L=xrf-l&T=0&F=&S=&P=1003).

Obituary - Andrew Lang (June 30, 2008)

Andrew Lang, Emeritus Professor of Physics at the University of Bristol, has died. Born in 1924 at St Annes-on-Sea in the UK, Professor Lang obtained a First-Class Honours London External BSc in Physics at Exeter in 1944, a London External MSc in 1947 and a Cambridge PhD in 1953. He worked in industrial research in the UK (Lever Brothers and Unilever Ltd) and in the USA (Philips Laboratories, Irvington-on-Hudson, NY). He was Assistant Professor of Physical Metallurgy at Harvard University (1954–1959) before moving to the University of Bristol. He became Professor of Physics in 1979. Professor Lang achieved fame for his pioneering studies in X-ray diffraction physics, especially his original technique of X-ray topography, i.e., the 'Lang method' or 'Lang Camera', which displays the internal imperfections in a crystal, such as dislocations, stacking faults, growth-sector boundaries and ferromagnetic domains. The method has been widely used in the non-destructive assessment of crystals for the electronics and diamond industries, among others. Professor Lang studied many types of X-ray diffraction phenomena, including variations from Bragg's law, X-ray moire patterns and other types of fringes. One of his most important discoveries (in collaboration with Professor N. Kato (1923–2002)) was the presence of interference fringes in wedge-shaped perfect crystals, leading to a precise measure of absolute structure amplitude from a unit cell (See the paper, "A study of pendellosung fringes in X-ray diffraction", Acta Cryst. **12,** 787 (1959)). Professor Lang is also known for his research using other techniques, such as electron microscopy and cathode-luminescence. In 1964, he was awarded the Charles Vernon Boys Prize of the Institute of Physics and the Physical Society. He was elected a Fellow of the Royal Society in 1975 and was awarded the Royal Society Hughes Medal in 1997. An obituary by Professor M. Moore can be found in the Journal of Applied Crystallography, **41,** 825 (2008). The Independent (August 25, 2008) carried an obituary as well.

Obituary - Vadim I. Nefedov (June 28, 2008)

Vadim Ivanovitch Nefedov, a member of the Russian Academy of Science (RAS), has died in Moscow due to cancer at the age of 70. Born in Magnitogorsk in the USSR, Professor Nefedov graduated from the Physicochemical Institute of Leipzig University in 1962. At Leipzig, he was one of the first research students of Armin Meisel at the Laboratory for X-Ray Spectroscopy. In 1965, he completed a post-graduate course at the Kurnakov Institute of General and Inorganic Chemistry, RAS, where he continued to work and later became head of a laboratory. Nefedov's main scientific work concerns physical chemistry by electron and X-ray spectroscopy, in particular, chemical binding and the structures of many types of materials and compounds. He published more than 400 papers and 10 monographs, which are very useful as comprehensive handbooks in this field. Professor Nefedov formulated an original theory of electron density transfer between ligands and predicted a *cis*-effect in compounds of nontransition metals, which was confirmed later in experiments. He developed a method for determining the effective charge of atoms in compounds and Madelung energy, which offered a new way of calculating the energy of chemical bonds. He provided a theoretical basis and developed an experimental procedure for quantitative X-ray photoelectron analysis of the surface of solids and depth profiling. Nefedov was awarded the 1985 USSR State Prize, 1989 RSFSR State Prize, the international title of X-ray Professor (1998), and the 2000 and 2005 Alexander von Humboldt Foundation Prizes. An obituary by Professors R. Szargan, E. Z. Kurmaev and C. E. Fadley can be found in the Journal of Electron Spectroscopy and Related Phenomena, **168,** 47 (2008).

New Products

IRD unveils X-ray photodiode (January 12, 2009)

International Radiation Detectors, Inc. (IRD) has announced the AXUV 100GX X-ray photodiode. The new X-ray detector is fully calibrated, and makes it possible to perform absolute measurement of X-ray flux with energies even over 100 keV. The detector features a large (10 mm x 10 mm square) active area with room-temperature operation and a small detector footprint. It requires no external voltage for operation. The nitrided-oxide front window provides up to a Gigarad (SiO2) of radiation hardness which is 10,000 times greater than standard PIN silicon photodiodes. For more information, visit the Web page, http://www.ird-inc.com/

Miniature synchrotron (January 7, 2009)

Lyncean Technologies, Inc., which was founded in Palo Alto, California, in 2001 by Stanford Professor Ronald Ruth's group, recently announced that its Compact Light Source (CLS) successfully performed hard X-ray phase contrast imaging. Some results appear on the cover of the January 2009 issue of the Journal of Synchrotron Radiation. The CLS is a miniature synchrotron which uses inverse Compton scattering to produce high-intensity, tunable, quasi-monochromatic X-ray beams. For more information, visit the Web page, http://www.lynceantech.com Their first scientific results are published in the paper, "Hard X-ray phase-contrast imaging with the Compact Light Source based on inverse Compton X-rays", M. Bech *et al*., J. Synchrotron Rad. 16, 43 (2009).

X-RAY Spectrometry

Rigaku's latest wavelength-dispersive XRF spectrometer (January 7, 2009)

The ZSX3 is the latest member of Rigaku's innovative ZSX family of wavelength dispersive XRF instruments. The 3.0 kW spectrometer, which has a tube-below design, comes with either a vacuum or helium environment for measurement. For more information, visit the Web page, http://www.rigaku.com/index_en.html

Corporate

Aribex receives second patent for handheld X-ray system (January 19, 2009)

Aribex, Inc., has announced that it has been allowed a second U.S. patent for its NOMAD Handheld X-ray System. The latest patent (Appl. # 20070269010) protects the central concept of having all components of the X-ray system in the same enclosure. This concept led to the development of the world's first handheld X-ray system. The previous patent #7,224,769 (October of 2007) was for the digital X-ray camera. For more information, visit the Web page, http://www.aribex.com/

SpectroscopyNow.com

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

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(www.interscience.com) DOI 10.1002/xrs.1183

News

Sciences

Synchrotron X-ray CT reveals a 300-million-year-old fossil brain (March 9, 2009)

A research team from the National Natural History Museum in Paris and the American Museum of Natural History in New York recently analyzed the 3D structure of a 300-million-year-old brain of a relative of sharks and ratfish at the European Synchrotron Radiation Facility (ESRF). This is the first time that the soft tissue of such an old fossil brain has ever been found, and the sample studied was found in Kansas, United Sates. The study was performed by combined use of absorption microtomography and a new holotomographic approach, which uses phase-contrasts. The analysis indicated that the area where the brain-like structure reaches the surface of the sample reveals a high concentration of calcium phosphate, whereas the surrounding matrix is almost pure calcium carbonate. The mineralization of the brain might be due to the presence of bacteria that covered the brain shortly before decay and induced its phosphatization. For information about the holotomographic approach, see the paper, ''Mixed transfer function and transport of intensity approach for phase retrieval in the Fresnel region'', P. Guigay *et al*., Opt Lett., **32**, 1617 (2007). For more information on this research, see the paper, ''Skull and brain of a 300-million-year-old chimaeroid fish revealed by synchrotron holotomography'', A. Pradela *et al*., Proceedings of National Academy of Science (published online before print March 9, 2009, doi: 10.1073/pnas.0807047106)

Snap shots of breathing myoglobin (February 24, 2009)

The use of short pulses of extremely bright synchrotron X-rays has opened up a new world. In Japan, Dr. S. Adachi (KEK, Tsukuba Japan) and his colleagues recently succeeded in recording movies during changes in the molecule structures of myoglobin. The samples used are frozen myoglobin crystals that had CO (carbon monoxide) stored inside before the start of the experiments. Even at 100K, irradiating pulsed laser light gave the trigger for the migration of CO molecules. To see changes in atomic scale, time-resolved X-ray diffraction measurements were performed. The obtained movie tells us that the CO molecules penetrate into a number of cavities in the crystal and even expand their size. The research group has obtained an important result suggesting some self-opening mechanism in the ligand migration channel. For more information, see the paper, ''Visualizing breathing motion of internal cavities in concert with ligand migration in myoglobin'', A. Tomita *et al*., Proceedings of National Academy of Science, **106,** 2612–2616 (2009) Published online before print February 9, 2009, doi: 10.1073/pnas.0807774106

X-ray spectra show evidence of unexpected substitutional alloying under high pressure (February 2, 2009)

In classical metallurgy, there exists a very famous rule known as Hume-Rothery's rule, which describes the conditions necessary for the formation of a solid solution from two independent metals. In order to have a substitutional crystalline solid solution in which the atoms of one element randomly substitute for atoms of another element in a crystal structure, the components must have an atomic size within 15% and electronegativity within 0.4 of each other. According to this rule, a Ce-Al solid solution cannot be obtained. Recently, a research team led by Professor H.K. Mao (Carnegie Institution of Washington) and Professor R. Ahuja (Uppsala University) found during high pressure research on the intermetallic compound of Ce_3Al that a solid solution is formed in a Ce-Al system. The differences in radii and electronegativity of Ce and Al were diminished by applying pressure. Both synchrotron X-ray studies (XRD and X-ray absorption spectroscopy) and *ab initio* calculations showed the same cause for bringing the two elements closer in radii and electronegativity, resulting in the new alloy phase. Even after the release of pressure, this substitutional alloy remained. During in-situ X-ray absorption measurements at the Ce LIII edge, conspicuous changes in the sharpness of the absorption, correlated to delocalization of 4f electrons, were observed. For more information, see the paper, ''Substitutional alloy of Ce and Al'', Q-S.Zeng *et al*., Proceedings of National Academy of Science, **106,** 2515–2518 (2009) Published online before print February 2, 2009, doi: 10.1073/pnas.0813328106

Time-resolved near edge X-ray absorption spectra in sub picosecond timescale (January 23, 2009)

X-ray absorption spectroscopy is one of the most powerful probes of molecular structures. So far, applications have been limited to the steady state and/or quite slowly changing systems. Recently, Professor M. Chergui (Ecole Polytechnique Federale de Lausanne, (EPFL), Switzerland) and his colleagues reported a very impressive ultrafast X-ray absorption experiment. There is a large class of Fe(II)-based molecular complexes that show two electronic states closely spaced in energy: a low-spin (LS) singlet and a high-spin (HS) quintet state. They therefore exhibit spin crossover (SCO) behavior, wherein conversion from a LS ground state to a HS excited state (or the reverse) can be induced by small changes in temperature and pressure or by light absorption. The studies were done for an aqueous solution of $[Fe^{II}(bpy)_3]^{2+}$, which serves as a model system for the family of Fe(II)-based SCO complexes. A 100-mm-thick free-flowing liquid jet of an aqueous solution of 50 mM $[Fe^{II}(bpy)_3]^{2+}$ was excited by an intense 400-nm laser pulse (115-fs pulse width, repetition rate 1 kHz), and a tunable femtosecond hard X-ray pulse from the slicing source was used to probe the system in transmission mode at 2 kHz. The X-ray flux was about 10 photons/pulse at 7 keV. The time resolution was under 250 fs. By recording the intensity of a characteristic near edge absorption spectral feature as a function of laser pump/X-ray probe time delay, the very early stages of photo excitation in Fe(II)-based complexes were clarified. For more information, see the paper, ''Femtosecond XANES Study of the Light-Induced Spin Crossover Dynamics in an Iron(II) Complex'', Ch. Bressler *et al*., Science, **323,** 489 (2009).

Professional

2009 Pittcon Heritage Award - A. Bader (March 8, 2009)

The Chemical Heritage Foundation (CHF) has announced that Dr. Alfred Bader (Cofounder of Aldrich Chemical Company, former chairman of Sigma-Aldrich Corporation) has received the 2009 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. Bader founded the Aldrich Chemical Company, a fine chemicals company that later would become the Sigma-Aldrich Corporation, the 80th largest chemical company in the United States. In 1995, he published his autobiography, "Adventures of a Chemist Collector", which details his experiences from Nazi-era refugee to chemist magnate to fine arts connoisseur. In 2008, the second autobiography has been published, "Chemistry & Art: Further Adventures of a Chemist Collector".

Symposium on micro and trace X-ray analysis in Japan (February 14, 2009)

An international symposium on micro and trace X-ray analysis was held in Osaka, Japan, on February 12–14, with financial aid from the Japan Science and Technology Agency (JST). Professor K. Tsuji (Osaka City Univ.) organized the symposium, which had 102 participants including 12 scientists from outside Japan. In addition to highly sophisticated analytical experiments with brilliant synchrotron radiation, recent progress regarding the instrumentation and applications of laboratory/mobile X-ray sources was extensively discussed. The speakers were as follows; P. Wobrauschek (Atominstitut, TU Wien), K. Janssens (Antwerp Univ.), A. Hokura (Tokyo Univ. of Sci.), K. Nakano (Osaka City Univ.), A. von Bohlen (ISAS Institute for Anal. Sci.), S. Maeo (Osaka Electro-Comm. Univ.), Y. Kataoka (Rigaku), G. Havrilla (Los Alamos National Lab), C. Numako (Tokushima Univ.), K. Hayashi (Tohoku Univ.), T. Sakae (Nihon Univ.), K. Sakurai (National Inst. for Materials Sci.), S. Hayakawa (Hiroshima Univ.), K. Tsuji (Osaka City Univ.), S. B. Dabagov (INFN, Frascati), N. Gao (X-Ray Optical Systems, Inc.), H. Soejima (Shimadzu), K. Taniguchi (Inst. of X-ray Tech. Co., Ltd), J. E. Fernandez (Bologna Univ.), H. Kumagai (Osaka City Univ.), A. Bando (Horiba Ltd.), K. Yamauchi (Osaka Univ.), B. De Samber (Ghent Univ.), Y. Kagoshima (Hyogo Univ.), C. Streli (Atominstitut, TU Wien), P. Pianetta (SLAC, Stanford), S. Shimoyama (Kibi International Univ.), R. Van Grieken (Antwerp Univ.). The proceedings booklet is available from the organizer, Phone/Fax: +81-6-6605-3080, tsuji@a-chem.eng.osaka-cu.ac.jp

Obituary - Toshihisa Horiuchi (December 26, 2008)

Toshihisa Horiuchi, the co-author of the first total-reflection X-ray fluorescence (TXRF) paper, has died from colorectal cancer at the age of 66 at a hospital in Fukuoka, Japan, where his son is a doctor. Horiuchi was a student at Kurume National College of Technology. Immediately after finishing school, he started work as a technical staffer at Professor Y. Yoneda's lab, Kyushu University. He became convinced that the use of a new detector would be crucial for opening up new opportunities in X-ray spectroscopy, and he eagerly proposed that his supervisor purchase Si(Li) and Ge detectors, although they were too expensive for the university lab at that time. One of the most important applications for the then new detectors was TXRF. The paper, "Optical Flats for Use in X-Ray Spectrochemical Microanalysis", Rev. Sci. Instrum. 42, 1069 (1971) is a very famous work. This reported the first successful results of TXRF. Horiuchi was aware of the significance of trace analysis of bio-medical specimens such as blood etc, and he wanted to employ TXRF for such applications. After the death of Professor Yoneda, he moved to another lab and worked in the field of organic thin films for electronic devices. He contributed substantially to both research and teaching students. On February 14, 2009 at Osaka City University, Japan, Professor K. Matsushige (Kyoto University), who had supervised Horiuchi for more than 18 years, gave a memorial speech, taking advantage of the opportunity of the international symposium on micro and trace X-ray analysis. The participants offered a silent prayer for Horiuchi.

New products

Novel low power X-ray source using carbon nano-structures (March 19, 2009)

The National Institute of Advanced Industrial Science and Technology (AIST), Tsukuba, Japan has recently announced its successful development of an X-ray source with a cathode made of carbon nano-structures, which consist of a mixture of carbon nano-tubes, nano-walls and nano-diamonds. The system requires very little power because of the extremely high efficiency of electron emissions. The X-ray source can work with two AA dry cell batteries (1.5V × 2). For more information, phone: +81–29—862—6216, FAX: +81-29-862-6212, presec@m.aist.go.jp

PANalytical's new software module for standardless analysis (March 6, 2009)

PANalytical has launched its new standardless analysis package, Omnian. This latest module in the company's SuperQ software suite is designed to be used with the Axios sequential X-ray fluorescence (XRF) spectrometer. For more information, visit the Web page, http://www.panalytical.com/

Portable X-ray units from GE Sensing & Inspection Technologies (February 23, 2009)

GE Sensing & Inspection Technologies has announced the release of the new ERESCO MF4 series of portable X-ray units for routine non-destructive inspection. For more information, visit the Web page, http://www.geinspectiontechnologies.com/

Shimadzu releases new EDXRF spectrometer (February 5, 2009)

Shimadzu has released a new compact energy-dispersive X-ray fluorescence (EDXRF) spectrometer, the EDX-GP. For more information, visit the Web page, http://www.shimadzu.com/

Oxford unveils new EDXRF spectrometer (January 30, 2009)

Oxford Instruments plc has released a new compact EDXRF spectrometer, the X-Supreme8000. For more information, visit the Web page, http://www.oxford-instruments.com/

Corporate

Oxford wins PLC award for Best Technology (March 12, 2009)

The PLC Awards event was founded in 1987 to reward excellence in the smaller quoted company sector. The winners of each of the eight award categories are presented with their awards at the annual PLC Awards Dinner, which is held in March. The PLC Awards Dinner is "the" City event of the year and is attended by 1,500 guests, including quoted companies, investment banks, fund managers, investment analysts, and corporate advisors. This year's dinner, presented by news personality Penny Smith, took place at The Grosvenor House Hotel in London, sponsored by PricewaterhouseCoopers LLP (PwC) in association with The London Stock Exchange. The winners are: BTG plc (Best Investor Communication), Asterand plc (Best Performing Share), Standard Life UK Smaller Companies Trust plc (Best Performing Smaller Company Fund), Marshalls plc (Achievement in Sustainability), Mears Group plc (New Company of the Year), Oxford Instruments plc (Best Technology), Robert Watson - Hilton Food Group plc (Entrepreneur of the Year), and Telecom plus plc (Company of the Year). For more information, visit the Web page, http://www.plc-awards.co.uk/index_2009.php

Bruker opens expanded demonstration facility in Yokohama (February 24, 2009)

Bruker Corporation has announced the opening of its expanded 3,000 square-meter demonstration facility, which is co-located with the R&D and manufacturing facility for X-ray analysis systems in Yokohama, Japan. The new Yokohama facility is the single largest combined Bruker applications laboratory in the world, showcasing a wide selection of novel life science, materials research and industrial systems including NMR, research MRI, EPR, MALDI-TOF/TOF, ESI-ITMS and ESI-Qq-TOF mass spectrometry, X-ray diffraction and crystallography, X-ray fluorescence (XRF), EDS accessories for SEM, FT-IR and thermal analysis systems. For more information, visit the Web page, http://www.bruker-axs.de/

XOS distributes lead analyzer in China (February 9, 2009)

XOS, Inc. has announced that it has reached a distribution and technical support agreement for its HDX 1000 Lead Analyzer with Skyray Instruments in China. Skyray is China's leading analytical instrument manufacturer. For more information, visit the Web page, http://www.xos.com/index.php

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(www.interscience.com) DOI 10.1002/xrs.1196

News

Sciences

Secondary enhancement in confocal X-ray micro fluorescence (May 22, 2009)

Confocal X-ray micro fluorescence is a method of 3D analysis, and uses the formation of confocal volume (probing microvolume) defined through the intersection of a focused excitation beam and the sensitive volume of a polycapillary lens placed in front of the detector. Because of increasing demands, the technique has been widely used at both synchrotron and laboratory sources. However, some essential problems in quantitative analysis have remained so far. Dr. A-G. Karydas (Institute of Nuclear Physics, N.C.S.R. ''Demokritos'', Greece) and his colleagues recently published a paper on the influence of the secondary fluorescence enhancement in this technique. For more information, see the paper, ''Secondary Fluorescence Enhancement in Confocal X-ray Microscopy Analysis'', D. Sokaras et al., Anal. Chem., Article ASAP, DOI: 10.1021/ac900688n

X-ray fluorescence confirms mechanism to increase the toughness of spider silk (April 24, 2009)

Spider silk is a tough yet light material, but recently it has been found that it becomes three times stronger by adding small amounts of metal such as Zn, Ti and Al. The idea was inspired by research which established that trace metals are frequently found in the toughest parts of some insect bodies. Bio-materials scientists think that such metals could be incorporated in the protein structures and lead to unusual mechanical properties. Dr. M. Knez (Max Planck Institute of Microstructure Physics, Halle, Germany) and his colleagues have succeeded in infiltrating Zn, Ti and Al by the application of atomic layer deposition technique. X-ray fluorescence spectra provided the evidence for them. For more information, see the paper, ''Greatly Increased Toughness of Infiltrated Spider Silk'', S-Mo Lee et al., Science, 324, 488-492 (2009).

Grazing-exit micro X-ray fluorescence analysis of plant (March 27, 2009)

Professor K. Tsuji (Osaka City University, Japan) and his colleagues recently reported an interesting application of grazing-exit micro X-ray fluorescence to the analysis of a leaf of *Camellia hiemalis*. In their experiments, a polycapillary X-ray lens was used to observe a 30 μm area. Grazing-exit geometry was employed to enable the observation of the near surface of the plant. For more information, see the paper, ''Grazing Exit Micro X-ray Fluorescence Analysis of a Hazardous Metal Attached to a Plant Leaf Surface Using an X-ray Absorber Method'', T. Awane et al., Anal. Chem., **81**, 3356-3364 (2009).

Nano-scale chemical imaging by STM with synchrotron X-rays (March 13, 2009)

At the Photon Factory, KEK, Japan, Dr. T. Okuda (University of Tokyo) and his colleagues have developed a new technique for determining the identity of groups of individual atoms. Scanning tunneling microscopy (STM) is an existing powerful characterization method, which can detect the atomic positions in real space. In order to upgrade the STM by giving it the capability to distinguish chemical species, the research group employed synchrotron X-rays, which excite core-level electrons in the sample's atoms. In this way, secondary electrons can be detected by the STM as they tunnel across the gap. The important point here is that the tunneling current depends on the chemical species. Accordingly, the technique provides chemical imaging. The current spatial resolution is around 10 nm. In the present research, Fe and Ni L absorption edges were chosen to control the core-level excitation. The beamline used was BL-13C. For more information, see the paper, ''Nanoscale Chemical Imaging by Scanning Tunneling Microscopy Assisted by Synchrotron Radiation'', T. Okuda et al., Phys. Rev. Lett. 102, 105503 (2009)

Influence of coherent length on TXRF and XSW (March 10, 2009)

Dr. A. von Bohlen (Institute for Analytical Sciences, Germany) and his colleagues recently published an interesting paper on the analysis of nanoparticles prepared on the substrate by grazing incidence X-ray Standing Waves (XSW) and Total Reflection X-ray Fluorescence (TXRF). The influence of coherence length of X-rays from different X-ray sources, the particle form, particle size and distribution are discussed. For more information, see the paper, ''The influence of X-ray coherence length on TXRF and XSW and the characterization of nanoparticles observed under grazing incidence of X-rays'', A. von Bohlen et al., J. Anal. At. Spectrom., 2009 (advance article) DOI: 10.1039/b811178b

Professional

The 3rd X-ray reflectivity school in Japan (May 22, 2009)

Demand for learning analytical techniques for surfaces and interfaces appears to be on the increase. At Tsukuba in Japan, the 3rd tutorial course on the analysis of thin films and multilayers by X-ray reflectivity was held on May 22. The first Japanese textbook that serves as an introduction to X-ray reflectivity was published in February, and the 7 authors gave lectures as part of the course. Further information is available at http://www.nims.go.jp/xray/ref/ (in Japanese only).

2009 Compton Award –S. Mochrie, M. Sutton, and G. Grubel (April 29, 2009)

The Advanced Photon Source (APS) and APS Users Organization has announced that the 2009 Arthur H. Compton Award has been presented jointly to Simon Mochrie, Mark Sutton, and Gerhard Grubel for their pioneering efforts in X-ray photon correlation spectroscopy (XPCS), which exploits the coherent properties of synchrotron X-rays to study the slow dynamics of condensed matter at short length scales. For more information on their pioneering work, see the paper, ''Observation of speckle by diffraction with coherent X-rays'', M. Sutton, S. G. J. Mochrie, T. Greytak, S. E. Nagler, L. E. Berman, G. A. Held, and G. B. Stephenson, Nature 352, 608-610 (1991). Former recipients of this award are: Andrzej Joachimiak and Gerold Rosenbaum (2007); Gunter Schmahl and Janos Kirz (2005); Martin Blume, Doon Gibbs, Kazumichi Namikawa, Denis McWhan (2003); Wayne A. Hendrickson (2001); Sunil K. Sinha (2000); Donald H. Bilderback, Andreas K. Freund, Gordon S. Knapp, Dennis M. Mills (1998); Philip M. Platzman, Peter M. Eisenberger (1997); Nikolai Vinokurov, Klaus Halbach (1995).

First beam generated by the hard X-ray laser at Stanford (April 21, 2009)

At the U.S. Department of Energy's SLAC National Accelerator Laboratory, scientists have observed the first beam generated by the hard X-ray laser. The Linac Coherent Light Source (LCLS) now supplies 1.5 Å wavelength coherent hard X-ray ultra short pulses with 100 femtosecond duration. Unlike conventional lasers, which use mirrored cavities to amplify light, the LCLS is a free-electron laser, creating light using free-flying electrons in a vacuum. The LCLS uses the final third of SLAC's two-mile linear accelerator to drive electrons to high energy and through an array of undulator magnets that steer the electrons rapidly back and forth, generating a brilliant beam of coordinated X-rays. LCLS scientists used only 12 of an eventual 33 undulator magnets to generate the facility's first laser light. It is the first time that an X-ray laser has operated at such short wavelengths in the truly hard X-ray region, with such brightness and short pulses. The laser paves the way to a new way of looking at not only the structure of matter but also its dynamics. By using laser pulses of less than 100 femtosecond duration, the dynamics of chemical reactions can be caught in process, and even single molecules can be imaged. For further information, see the facility's Web page, http://home.slac.stanford.edu/pressreleases/2009/20090421.htm In Science Now Daily News, Adrian Cho wrote a comprehensive article, http://sciencenow.sciencemag.org/cgi/content/full/2009/421/2

Nature Materials Insight devoted to electron and X-ray microscopy (April 1, 2009)

In Issue 4, vol. 8 (2009) of Nature Materials, the Insight section features a compilation of articles on recent electron and X-ray microscopy. The aim is to illustrate what are the most outstanding capabilities of modern imaging techniques based on electrons and X-ray photons, which have been often treated separately. The 6 articles in the compilation are as follows: ''Is science prepared for atomic-resolution electron microscopy?'', Knut W. Urban (p.260-262); ''Structure and bonding at the atomic scale by scanning transmission electron microscopy'', David A. Muller (p.263-270); ''Electron tomography and holography in materials science'', Paul A. Midgley & Rafal E. Dunin-Borkowski (p.271-280); ''Near-edge X-ray absorption fine-structure microscopy of organic and magnetic materials'', Harald Ade & Herman Stoll (p.281-290); ''Coherent X-ray diffraction imaging of strain at the nanoscale'' Ian Robinson & Ross Harder (p.291-298); ''X-ray imaging beyond the limits'', Henry N. Chapman (p.299-301). Visit the Web page to download the full Insight as PDF file (4.77MB), http://www.nature.com/nmat/journal/v8/n4/pdf/nmat-insight-microscopy.pdf

Obituary - Tomoya Arai (March 11, 2009)

Tomoya Arai, a renowned specialist in X-ray fluorescence spectroscopy and an adviser to Rigaku Corporation, has died at the age of 77 in Osaka, Japan. Dr. Arai was born in 1931 in Tokyo. He was a student at Tokyo Metropolitan University. Immediately after finishing school, he joined Rigaku, where he devoted his life to the development of innovative X-ray fluorescence technologies. In 1962, Dr. Arai developed the first automatic sequential wavelength-dispersive spectrometer in Japan. In 1967, he oversaw the commercialization of an on-line X-ray coating thickness gauge. This was an important industrial application of X-ray fluorescence spectroscopy. In 1969, Dr. Arai proposed the use of an end window Rh tube in an X-ray fluorescence spectrometer. This innovation opened up new opportunities in light element analysis. In 1981, he established a way of analyzing boron. In 1998, Dr. Arai obtained a PhD from the University of Tokyo, where his supervisor was Professor Y. Nihei. Dr. Arai was a recipient of the Birks Award at the 2004 Denver Conference. Some of his valuable experiences have been published in scientific journals. One interesting paper is the ''Intensity and distribution of background X-rays in wavelength-dispersive spectrometry'', X-Ray Spectrometry, 20, 9-22 (1991). Dr. Arai often spoke of the need to take heed of the raw data. Even in his later years, he never stopped looking at the raw data with his own eyes.

Commissioning proceeds well at Shanghai (March 2, 2009)

At the Shanghai Synchrotron Radiation Facility (SSRF) in China, the Hard X-ray Microfocus Beamline (BL15U1) was commissioned satisfactorily from February to March 2009. The beamline is equipped with an in-vacuum undulator. For further information, visit the Web page, http://ssrf.sinap.ac.cn/english/

New products

Toshiba introduces new multi-detector CT systems (May 20, 2009)

Toshiba America Medical Systems, Inc. has introduced two advanced multi-detector CT systems, the AquilionR Premium edition and the Aquilion CX edition.

For further information, contact Charlene Jacobs, Phone +1-714-669-7811, cjacobs@tams.com

Bruker's new simultaneous WDXRF spectrometer (April 29, 2009)

Bruker AXS has introduced the S8 LION simultaneous WDXRF spectrometer for process and quality control in the cement, minerals and mining industries. It can simultaneously measure up to 16 elements with a precision of 0.05% and with a time-to-result of less than 1 min. For further information, visit the web page, http://www.bruker-axs.de/

Spellman's new X-ray source offering 100 kV (March 31, 2009)

Spellman High Voltage Electronics Corporation has announced the expansion of its MonoblockR Series of X-ray Sources with the introduction of the new XRB100, which operates up to 100 kV at full power of 100 W. The XRB100 has a stationary, tungsten anode X-ray tube, and provides a fan-shaped X-ray beam geometry. For further information, visit the web page, http://www.spellmanhv.com

Corporate

Xradia 3D X-ray images key for University of Texas scan of famous fossil ''Lucy'' (April 29, 2009)

Xradia, Inc., a developer and manufacturer of ultra-high-resolution 3D X-ray imaging systems, has announced that its scanner was used by researchers at The University of Texas at Austin in the examination of fossil Lucy, the world's most famous ancient human ancestor fossil that dates back 3.2 million years. The company's Xradia MicroXCT^{TM} scanner, a 3D X-ray computed tomography system with sub-micron resolution, was used to scan selected pieces of the fossil, and the resulting data will assist in their studies to learn how Lucy's skeleton supported her movement and posture, and how it compares to modern humans and apes. Lucy is currently on loan from the Ethiopian Government and on tour in the U.S. as part of a world premiere exhibit organized by the Houston Museum of Natural Science. For further information, visit the web page, http://xradia.com

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X-RAY Spectrometry

(www.interscience.com) DOI 10.1002/xrs.1211

News

Sciences

In situ synchrotron X-ray studies on Ge nano dots during growth under UHV conditions (July 16, 2009)

It is well known that the physical properties of semiconductor nanostructures, which have been grown in most cases by the Stranski-Krastanow (SK) mechanism, depend on their size, shape, strain and composition. In the case of the growth of Ge on Si(001), where the 2D-3D transition is driven by the 4.16% lattice mismatch between Ge and Si, the increase of Ge coverage above a critical thickness of around 4 ML can make coherent islands. First, square pyramids appear, and then dome-shaped islands are formed. At about 9 ML, the misfit strain can no longer be accommodated coherently and larger islands called superdomes are present. This raises detailed questions as to dependence on the growth rate, temperature etc. To provide answers to such questions, in-situ X-ray studies are extremely important. Professor G. Bauer (Institute of Semiconductor and Solid State Physics, Johannes Kepler University in Linz, Austria) and his colleagues recently performed grazing-incidence small angle X-ray scattering (GISAXS) and diffraction (GID) experiments with a UHV-MBE chamber. They clarified the kinetics of the growth of Ge superdomes and their facets on Si(001) surfaces, as a function of deposited Ge thickness for different growth temperatures at a low growth rate, by in situ grazing-incidence small-angle x-ray scattering in combination with in situ grazing-incidence x-ray diffraction. At a low growth rate, intermixing is found to be enhanced and superdomes are formed already at lower coverages than previously reported. In addition, the research team observed that at the dome-to-superdome transition, a large amount of material is transferred into dislocated islands, either by dome coalescence or by anomalous coarsening. Once dislocated islands are formed, island coalescence is a rare event and introduction of dislocations is preferred. The superdome growth is thus stabilized by the insertion of dislocations during growth. For more information, see the paper, ''In situ X-ray scattering study on the evolution of Ge island morphology and relaxation for low growth rate: Advanced transition to superdomes'', M.-I. Richard *et al*., Phys. Rev. B 80, 045313 (2009).

Possibility of atomic inner-shell X-ray laser (July 14, 2009)

Since 1984, laboratory-scale X-ray lasers have been extensively studied. The shortest wavelength achieved so far is 3.6 nm, with a weak intensity. On the other hand, X-ray free-electron lasers (XFEL) based on self-amplified spontaneous emission (SASE) from a long undulator in the linear electron accelerator will be available in near future. The next idea is the use of XFEL to pump a photoionization inner-shell X-ray laser in an atomic gas. Dr. R. London (Lawrence Livermore National Lab) and a colleague have recently published their theoretical calculations. For more information, see the paper, ''Atomic inner-shell X-ray laser pumped by an x-ray free-electron laser'', N. Rohringer *et al*., Phys. Rev. A 80, 013809 (2009).

A new technique with coherent X-rays to determine non-crystalline structures (July 14, 2009)

Professor H. Dosch (Director of Deutsches Elektronen-Synchrotron (DESY), Germany) and his colleagues recently published a very interesting paper on the symmetry of disordered systems. They propose a new technique, X-ray cross correlation analysis (XCCA). This measures X-ray speckles and is basically an extension of X-ray photon correlation spectroscopy (XPCS). The samples studied were colloidal glasses, and the research group was able to observe clear symmetries that conventional X-ray diffraction has been unable to extract. The research group recommends using brilliant coherent X-ray sources, such as X-ray free electron lasers for future research. For more information, see the paper, ''X-ray cross correlation analysis uncovers hidden local symmetries in disordered matter'', P. Wochnera *et al*., Proc Nat Aca Sci, 106, 11511 (2009).

Single-shot coherent X-ray diffraction with a table-top soft X-ray source (July 8, 2009)

Imaging individual objects of several nanometer resolution in space and several femtosecond resolution in time, is now one of the most exciting experiments in X-ray physics. Over the past decade, coherent X-ray diffraction has overcome a lot of limits in imaging noncrystalline objects at a resolution in the order of X-ray wavelength. So far, X-ray free electron lasers (or, in the mean time, 3rd generation synchrotron sources) have been considered as a promising source, but the table-top source is no doubt extremely important for many new sciences. Recently, Dr. H. Merdji (CEA Saclay, France) and his colleagues reported the feasibility of a laser-driven soft X-ray source, which uses the 25th harmonics (32 nm wavelength, 20 fs pulse width) of a Ti : sapphire laser. They succeeded in observing diffraction patterns from isolated nano-objects with a single 20 fs pulse. Images were reconstructed with a spatial resolution of 119 nm from the single shot and 62 nm from multiple shots. For more information, see the paper, ''Single-Shot Diffractive Imaging with a Table-Top Femtosecond Soft X-Ray Laser-Harmonics Source'', A. Ravasio *et al*., Phys. Rev. Lett. 103, 028104 (2009).

X-ray absorption and high-resolution Kα emission studies on sulfur compounds (July 2, 2009)

Dr. P. Glatzel (European Synchrotron Radiation Facility (ESRF), Grenoble, France) and his colleagues recently published an interesting paper reporting systematic studies on both X-ray absorption and Kα emission spectra from sulfur compounds. The compounds' spectra were compared with quantum chemical calculations using density functional, multiple-scattering, and atomic multiplet theory. It was found that the near-edge absorption spectra are mainly determined by the geometry of the first coordination sphere in the case of the sulfates and sulfite, while strong orbital hybridization in the case of sulfides results in a much more complex analysis. On the other hand, the spectral shape of the Kα fluorescence lines shows little influence of the chemical environment, but its energy position is correlated with the valence-shell electron population. The experiments were done at beamline ID26, ESRF. The spectrometer used for Kα emission is a combination of a Johansson Si(111) crystal and a CCD camera. The energy resolution was 0.44 eV for S Kα. For more information, see the paper, ''Electronic Structure of Sulfur Studied by X-ray Absorption and Emission Spectroscopy'', R. A. Mori *et al*., Anal. Chem., Article ASAP, DOI: 10.1021/ac900970z

Sub micron resolution XRF tomography reveals composition of 'star dust' (July 2, 2009)

In January 2006, NASA's Stardust spacecraft brought comet coma particles and interstellar grains from Comet 81P/Wild2. Synchrotron facilities all over the world have been used for extensive analysis of the chemical composition and crystal structures of the matter. Recently, Professor L. Vincze (X-ray Microspectroscopy and Imaging Group, Ghent University, Belgium) and his colleagues reported the results of 3D X-ray imaging based on X-ray fluorescence (XRF) tomography. In the present research, a 200 nm beam was employed, because the typical size of the particles from space was 2 microns. The measurement consisted of 2D scanning XRF maps for each rotation angle of the sample. In the XRF spectra, many peaks were found; Ca, Cr, Mn, Fe, Cu, Se etc. For more information, see the paper, ''X-ray Fluorescence Nanotomography on Cometary Matter from Comet 81P/Wild2 Returned by Stardust'', G. Silversmit *et al*., Anal. Chem., Article ASAP, DOI: 10.1021/ac900507x For related work on the same 'star dust' by other groups, for example, see ''Chondrulelike Objects in Short-Period Comet 81P/Wild 2'', Tomoki Nakamura *et al*., Science, 321, 1664–1667 (2008) and ''Mixing Fraction of Inner Solar System Material in Comet 81P/Wild2'', A. J. Westphal *et al*, The Astrophysical Journal, 694, 18–28 (2009).

A feasible flow-cell for time-resolved X-ray absorption spectroscopy (January 8, 2009)

Professor T. Rayment (School of Chemistry, University of Birmingham, UK) and his colleagues have developed a channel-flow cell to study electrochemical reactions on electrodes by time-resolved X-ray absorption spectroscopy. During the studies with the model system, it was found that a flowing solution is essential to remove any products of beam damage. For more information, see the paper, "Channel-Flow Cell for X-ray Absorption Spectroelectrochemistry", R. J. K. Wiltshire *et al*., J. Phys. Chem., C 113, 308 (2009)

Professional

Workshop on 'buried' interface science with X-rays and neutrons (July 14, 2009)

The 2009 workshop on 'buried' interface science with X-rays and neutrons was held at Akihabara campus, Tsukuba University, Japan, on July 13–14, 2009. The workshop was the latest in a series held since 2001; Tsukuba (December 2001), Niigata (September 2002), Nagoya (July 2003), Tsukuba (July 2004), Saitama (March 2005), Yokohama (July 2006), Kusatsu (August 2006), Tokyo (December 2006), Sendai (July 2007), Sapporo (September 2007), Tokyo (December 2007) and Tsukuba (March 2009). There are increasing demands for sophisticated metrology in order to observe multilayered materials with nano-structures (dots, wires, etc), which are finding applications in electronic, magnetic, optical and other devices. X-ray and neutron analysis is known for its ability to observe in a non-destructive manner even 'buried' function interfaces as well as the surface. In addition to such inherent advantages, recent remarkable advances in micro analysis and quick time-resolved analysis in X-ray reflectometry are extremely important. The present workshop gathered together those with different research backgrounds, i.e., from semiconductor electronics to chemical bio materials, and even theoretical groups were invited to give insights into unsolved problems on buried interfaces. The workshop proceedings will be published in Transactions of the Materials Research Society of Japan, no later than the end of 2009.

A new hard X-ray beamline at SAGA Light Source (July 13, 2009)

Kyushu University has recently constructed its own new beamline at the SAGA Light Source, which is one of Japan's compact synchrotron facilities. For more information, visit the Web page, http://www.saga-ls.jp/

Account of Stanford's X-ray laser in Nature Photonics (June 30, 2009)

As reported here previously, in April this year, the first 1.5 Å wavelength laser light was generated at Stanford, USA. An interesting account of the hard X-ray laser was published in Nature Photonics. See the article, "Free electron lasers: First light from hard X-ray laser", B. McNeil, Nature Photonics, 3, 375–377 (2009).

New Products

PANalytical's vacuum system for X-ray analysis (July 15, 2009)

PANalytical in co-operation with Edwards Ltd. has developed a fully automatic low- and high-vacuum system for non-ambient chambers. The new system will be added to the series of PANalytical products. For further information, visit the web page, http://www.panalytical.com/

Visualization of calcium atom by improved JEOL microscope (July 5, 2009)

A research team led by Dr. K. Suenaga (National Institute of Advanced Industrial Science and Technology (AIST), Tsukuba, Japan) recently announced that it has successfully developed an electron microscope that enables element analysis of organic molecules. They demonstrated that a single atom of calcium in nano materials can be visualized by the use of new spherical aberration correction at low voltage, from 30 to 60kV. For further information, visit the Web page, http://www.jeol.com/NEWSEVENTS/PressReleases/tabid/521/newsid901/153/Success-in-Visualizing-Calcium-Atom/Default.aspx The research paper is also available, "Visualizing and identifying single atoms using electron energy-loss spectroscopy with low accelerating voltage", K. Suenaga *et al*., Nature Chemistry, Published online: 5 July 2009, DOI:10.1038/nchem.282

Corporate

Boeing's GOES-O satellite launched with e2v image sensors (July 7, 2009)

e2v has supplied image sensors for the Geostationary Operational Environmental Satellite, GOES-O, which was launched on June 26, 2009. GOES-0 is the latest in a series of satellites that monitor Earth and space weather systems, in order to improve predictions regarding hurricanes, flash floods and severe storm warnings, and to help track global climate change. For further information, visit the web page, http://www.e2v.com/

Portable Analytical Solutions to distribute Niton handheld XRF analyzer (July 2, 2009)

Thermo Fisher Scientific Inc., has announced that Portable Analytical Solutions (PAS) will become a new distributor of Thermo Scientific Niton handheld X-ray fluorescence (XRF) analyzers for Australia, New Zealand, Fiji and Papua New Guinea. For further information, visit the web page, http://www.niton.com/

Rigaku and PerkinElmer collaborate in element analysis (June 11, 2009)

PerkinElmer, Inc. and Rigaku Americas have announced that both companies will share information on element analysis and provide customers with a single point of contact. In many analytical applications, efficiency can be enhanced by combining and enhancing atomic spectroscopy (atomic absorption spectrometers (AAS), inductively coupled plasma optical emission spectrometers (ICP-OES) and inductively coupled plasma mass spectrometers (ICP-MS)) and X-ray fluorescence (XRF). For further information, visit the web page, http://www.rigaku.com/downloads/press/xrf-pe.html

SpectroscopyNow.com

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

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(www.interscience.com) DOI 10.1002/xrs.1229

News

Sciences

Quick X-ray absorption spectrometry clarifies chemical reaction of environmental contaminants (September 22, 2009)

Professor D. Sparks (University of Delaware, USA) and his colleagues have reported an interesting application of quick X-ray absorption spectrometry to environmental science. The experiment is basically a continuous monochromator scan (0.3 – 0.6 sec for each spectrum) at the synchrotron beamline at Brookhaven National Lab. The main interest here is the initial oxidation rate of As(III) to As(V) by hydrous manganese(IV) oxide, because the toxicity and availability of arsenic to living organisms depends on its oxidation state at the interface to the water. The research team found that the initial apparent As(III) depletion rate constants are nearly twice as large as those measured with conventional, but much slower techniques. This indicates the necessity of further studies using such a rapid analytical method. For more information, see the paper, "Quantification of rapid environmental redox processes with quick-scanning x-ray absorption spectroscopy (Q-XAS)", M. Ginder-Vogel *et al.*, Proc Nat Aca Sci, **106,** 16124 (2009).

Geochemical study on As-S system by X-ray spectroscopy (September 18, 2009)

It is known that sulfide sometimes play a significant role in the geochemistry of arsenic under reducing conditions. So far, it has been assumed that sulfide primarily reduced the solubility and mobility of arsenic by precipitation of arsenic-sulfide minerals, As_2S_3, but recent studies indicate that under certain conditions, significant concentrations of soluble As-S compounds can exist in sulfidic waters. Thus, the question is whether they are As(III)-S species ("thioarsenites") or As(V)-S species ("thioarsenates"). A research group led by Dr. B. Planer-Friedrich (University of Bayreuth, Germany) has recently reported that use of X-ray absorption spectroscopy (XANES and EXAFS) can determine the concentration ratio of each species. The experiment was done at beamline BM20, ESRF. For more information, see the paper, "Discrimination of Thioarsenites and Thioarsenates by X-ray Absorption Spectroscopy", E. Suess *et al.*, Anal. Chem., Article ASAP (2009), DOI: 10.1021/ac901094b

Theoretical calculation of Cu Kα spectra (September 16, 2009)

Dr. C. T. Chanter and his colleagues have published a paper on the unresolved quantitative discrepancies between experimental and theoretical Cu Kα spectra. For more information, see the paper, "Theoretical Determination of Characteristic X-Ray Lines and the Copper Kα Spectrum", C. T. Chantler *et al.*, Phys. Rev. Lett. 103, 123002 (2009).

Soft X-ray laser produces 'transparent aluminum' (September 1, 2009)

In the film Star Trek IV (1986), transparent aluminum is used for the exterior portals and windows of spacecraft. Now transparent aluminum has become a hot topic for real, rather than in science fiction. An international team, led by Oxford University scientists, has recently reported that a short pulse from the FLASH laser (wavelength 13.5 nm) knocks out a core L-shell electron from every aluminium atom in a 50 nm Al thin film without destroying the metal's crystalline structure. This rendered the aluminium almost invisible for this wavelength. This phenomenon is called saturable absorption. The transient state of aluminium produced in this way is as dense as ordinary matter but can only exist for an extremely short period of time of 40 femtoseconds. For more information, see the paper, "Turning solid aluminium transparent by intense soft X-ray photoionization", B. Nagler *et al.*, Nature Physics 5, 693 (2009).

Coherent X-rays reveals dynamics of atomic-scale diffusion (September 1, 2009)

So far, diffusion in solids has been investigated by profiling the depth dependence of tracer atoms diffused into the sample. Although one can obtain the diffusion constant from this, the question is how diffusion takes place on the atomic scale, rather than on the micron scale. Sometimes quasielastic neutron scattering as well as Mobauer spectroscopy can be used in a very limited number of fortunate cases. A research group led by Professor G. Vogl (University of Vienna, Austria) recently reported the use of X-ray photon correlation spectroscopy (XPCS) to observe the dynamics of diffusing atoms. The research was done for intermetallic alloy $Cu_{90}Au_{10}$, at temperatures of around 540 K, where the system is a substitutional solid solution, that is, the Au atoms statistically occupy sites in the Cu fcc lattice. The research gives the dynamical behavior of single atoms as a function of their neighborhood, and confirms quantitatively that Au atoms have a tendency to locally order on a certain set of sites in the crystal. Photon correlation spectroscopy is based on analysis of 'speckle' patterns, which are fine-scale diffraction patterns that appear in the scattering of coherent light from a disordered system. Speckle patterns are sensitive to the exact spatial arrangement of the disorder. By observing the intensity fluctuations in the speckle pattern, the characteristic times of fluctuations in the system can be determined. For more information, see the paper, "Atomic diffusion studied with coherent X-rays", M. Leitner *et al.*, Nature Materials, **8,** 717 (2009).

Spectral shape of K X-rays produced by ultra short pulse laser (August 27, 2009)

When a strong laser beam hits the surface of a material, plasma is produced there, subsequently leading to the emission of a short burst of X-rays. It is believed that the electrons in the surface plasma are accelerated by the strong electric field of the laser and then penetrate the solid behind. There, they knock out electrons from inner electronic shells, which subsequently undergo inner-shell recombination, leading to characteristic line emissions such as Kα and Kβ spectra. A research group led by Professor U. Teubner (University of Applied Sciences, Emden, Germany) has reported detailed experimental results on copper and titanium K X-rays. Particular attention has been paid to the interplay between the angle of incidence of the laser beam on the target, as well as the influence of prepulses. For more information, see the paper, "Optimized K x-ray flashes from femtosecond-laser-irradiated foils", W. Lu *et al.*, Phys. Rev. E 80, 026404 (2009).

Solution of phase problem in X-ray crystallography (August 10, 2009)

In X-ray diffraction experiments, one measures the intensity (amplitude) of the diffracted X-rays as a function of position in the reciprocal space, and the information on the phase is always missing. For many years, this so-called phase problem has been thought as one of the biggest problems in X-ray crystallography. Professor E. Wolf (University of Rochester, New York) has recently published a very interesting and inspirational paper. He is famous for several important textbooks on optics and also for his presidency of the Optical Society of America. The present paper is theoretical, and starts with a criticism of basic understanding of the problem. The author says that trying to measure the phase is rather meaningless. Almost all scientists assume that the incident X-ray beam is monochromatic in the data analysis, but the author points out that a monochromatic beam is not possible in reality. Any beam that can be produced in a laboratory is, at best, quasimonochromatic and, therefore, even if both the amplitudes and the phases are given, it is still not possible to solve the problem. Alternatively, the author proposes the measurement of certain correlation functions, with the use of spatially coherent beams. While it is extremely important to think about a future strategy regarding the final solution

of the phase problem as discussed in the paper, the author makes no mention of the recent significant strides in coherent X-ray scattering. For more information, see the paper, ''Solution of the Phase Problem in the Theory of Structure Determination of Crystals from X-Ray Diffraction Experimentst'', E. Wolf, Phys. Rev. Lett. **103,** 075501 (2009).

X-ray nanointerferometer (August 3, 2009)

X-ray phase-contrast imaging is extremely powerful for visualizing internal structures with low-Z matrices, which are most likely in bio-medical specimens. The use of an X-ray interferometer is one of the most promising ways forward for this imaging technology, but resolution has been limited to the micrometer scale so far. A research group led by Dr. A. Snigirev (European Synchrotron Radiation Facility, Grenoble, France) has recently developed a novel type of X-ray interferometer employing a bilens system with two parallel arrays of compound refractive lenses, each of which creates a diffraction limited beam under coherent illumination. The energy of the X-rays is 10–20 keV and the material used in the refractive lenses is silicon. When the two beams overlap, they produce an interference pattern with fringe spacing ranging from tens of nanometers to tens of micrometers. Readers may notice that the system is similar to the model of a Billet split lens in classical optics (See Fig. 7.8, page 263 in ''Principle of Optics'', M. Born and E. Wolf, 6th Ed, Pergamon Press (1988)). The use of a modern synchrotron source and this novel optical device thus opens up a new field and could revive old theorems. Coherent moiré imaging or radiography are promising straightforward applications. For more information, see the paper, ''X-Ray Nanointerferometer Based on Si Refractive Bilenses'', A. Snigirev *et al*., Phys. Rev. Lett., **103,** 064801 (2009).

Professional

Removing all electrons from neon by X-ray laser (September 18, 2009)

At Stanford's linac coherent light source (LCLS), a great deal of effort has been devoted since April this year to initial scientific tests of an X-ray laser. In September, scientists attempted to strip all ten electrons from an atom of neon. They were able to adjust the proportion of different neon species, from non-ionized Ne (no missing electrons) to Ne^{10+} (lacking all 10 electrons), by fine-tuning the powerful LCLS X-ray beam. For more information, visit the Web page, http://today.slac.stanford.edu/

Stimulus funds help Cornel's ERL (September 14, 2009)

Nearly $19 million in funding through the American Recovery and Reinvestment Act is supporting the Cornell High Energy Synchrotron Source (CHESS), Cornell Electron Storage Ring (CESR) and ongoing efforts to plan and build a new linear accelerator, the Energy Recovery Linac (ERL). So far, Cornell has received more than 90 ARRA grants, totally about $76 million. For more information, visit the Web page, http://www.news.cornell.edu/

X-ray imaging of Ashura sculpture (September 8, 2009)

Japan is celebrating the 1,300th anniversary of Kohfukuji Temple in Nara. The temple's sculpture of Ashura, one of the greatest treasures of the early to mid-7th century, is on exhibition at Kyushu National Museum in September. The exhibition features some X-ray imaging results of non-destructive observation of the interior of the sculpture. The images establish that the sculpture is still in good condition and also give a lot of information on the materials and methods used in its creation. Information on Ashura is available at the following Web page, http://en.wikipedia.org/wiki/Asura_(Buddhism)

Chandrayaan-1's mission declared over (August 31, 2009)

Chandrayaan-1 was a lunar probe launched by the Indian Space Research Organization (ISRO). It was equipped with advanced X-ray spectrometers for investigation. After suffering from several technical problems including failure of the star sensors and insufficient thermal shielding, Chandrayaan stopped sending radio signals on August 29, 2009 shortly after which the ISRO officially declared the mission over. Chandrayaan operated for 312 days from October 2008. For more information, visit the Web page, http://www.isro.org/Chandrayaan/htmls/home.htm

Denver X-ray conference awards (July 29, 2009)

The following awards were presented during the plenary session of the 58th Annual Denver X-Ray Conference:

The 2009 Barrett Award was presented to Robert Von Dreele, Argonne National Laboratory, Argonne, IL.

The 2009 Jenkins Award was presented to Tim Fawcett, International Centre for Diffraction Data, Newtown Square, PA.

There was no winner for the 2009 Jerome B. Cohen Student Award.

Nature News on the application of carbon nanotube X-ray source (July 28, 2009)

A recent edition of Nature News featured the successful application of a carbon nanotube (CNT)-based X-ray source to medical imaging. A group led by Professor O. Zhou (University of North Carolina in Chapel Hill, USA) has developed a micro 3D CT system. The main idea behind such very rapid scanning is simply electronic switching of 3D arrayed CNT X-ray sources, rather than mechanical motion. For more information, see the article, ''Nanotubes sharpen X-ray vision'', Zeeya Merali, Nature News, doi:10.1038/news.2009.744 The original research papers were published in April 2009 (''A dynamic micro-CT scanner based on a carbon nanotube field emission X-ray source'', G Cao *et al Phys. Med. Biol.* 54, 2323 (2009))

New Products

HiTek Power's new 70 kV power supply (September 9, 2009)

HiTek Power has recently extended its comprehensive Series XRG70 by introducing the XRG70-703, a compact high voltage power supply that has been specifically developed for high performance analytical X-ray applications. The maximum output power is 70 W. For further information, visit the web page, http://www.hitekpower.com/

Corporate

Horiba's new facility in Paris (September 16, 2009)

Horiba has recently announced that the company will build a new research facility on the Campus of Ecole Polytechnique, in Saclay near Paris, France. The 7500 m^2 facility will open its doors in late 2011. For further information, visit the web page, http://www.horiba.com/

SII Nanotech to market Bruker's S1 TURBO and S1 SORTER (August 25, 2009)

SII Nanotechnology has recently decided to market Bruker AXS's S1 TURBO and S1 SORTER handheld XRF analyzers in Japan. For further information, visit the web page, http://www.siint.com/en/index.shtml Technical information on the SI TURBO can be found at http://www.bruker-axs.de/handheldx-rayspectrometry.html

Rigaku's new EDXRF Center in Austin, Texas (July 27, 2009)

Rigaku Corporation has recently formed a new research and development, manufacturing, sales, service and support subsidiary - Applied Rigaku Technologies, Inc. (ART), which is dedicated to energy dispersive X-ray fluorescence (EDXRF) and related elemental analysis technologies. The new company is located in the northwest quadrant of Austin, Texas. For further information, contact: Robert Bartek, President, Applied Rigaku Technologies, Inc., Phone: +1-512-633-4325, E-mail, robert.bartek@rigaku.com

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