

## SYNCHROTRON LIGHT NEWS

### WORTH READING

#### Can ZnO doped by transition metal be ferromagnetic?

**(January 2010).** Scientists from US and France proved by using synchrotron-based spectroscopy that as long as phase separation or excessive defect formation is absent, Co:ZnO is paramagnetic. They established quantitative thresholds based on four reliable quality indicators using XAS; samples that show ferromagnet-like behavior fail to meet these quality indicators, and complementary experimental techniques indeed prove phase separation. Careful analysis of XAS spectra is shown to provide quantitative information on the presence and type of dilute secondary phases in a highly sensitive, non-destructive manner. XAS and XMCD spectra were collected at the ID12 beamline of European Synchrotron Radiation Facility (ESRF).

A. Ney, M. Opel, T. C. Kaspar, V. Ney, S. Ye, K. Ollefs, T. Kammermeier, S. Bauer, K.-W. Nielsen, S.T.B. Goennenwein, M.H. Engelhard, S. Zhou, K. Potzger, J. Simon, W. Mader, S.M. Heald, J.C. Cezar, F. Wilhelm, A. Rogalev, R. Gross, S.A. Chambers, "Advanced spectroscopic synchrotron techniques to unravel the intrinsic properties of dilute magnetic oxides: the case of Co:ZnO," *New J. Phys.* 12 (2010) 013020-1-16. (KLJ)

#### Complex nature of wood determined by tomographic techniques

**(January 2010).** The structure of various wood samples has been studied at SLS (Switzerland) by a group of Swiss scientists. The tomographic microscopy is found to be helpful in understanding the wood features at the length scale of several microns.

D. Mannes, F. Marone, E. Lehmann, M. Stampanoni, P. Niemz, "Application areas of synchrotron radiation tomographic microscopy for wood research," *Wood Sci. Technol.* 44 (2010) 67-84. (WP)

#### High-pressure EXAFS study of GeO<sub>2</sub>

**(January 2010).** An international team from US, France and Italy performed high-pressure EXAFS measurements on amorphous GeO<sub>2</sub> over increasing and decreasing pressure cycles, at pressure up to 44 GPa. The results shed light on the GeO<sub>2</sub> densification process and on the nature of the amorphous-amorphous transition, suggesting that the transition is more gradual and continuous than what has been previously reported. X-ray absorption spectra were collected at the ID24 dispersive-EXAFS beamline of European Synchrotron Radiation Facility (ESRF).

M. Baldini, G. Aquilanti, H.-K. Mao, W. Yang, G. Shen, S. Pascarelli, W.L. Mao, "High-pressure EXAFS study of vitreous GeO<sub>2</sub> up to 44 GPa," *Phys. Rev. B* 81 (2010) 024201-1-6. (KLJ)

#### Intrinsic properties of Co:ZnO unraveled by X-ray absorption spectroscopy

**(January 2010).** Advanced synchrotron-based XAS at the Co K-edge performed by a team of American and German scientists provides a direct and sensitive probe of specimen quality and in this way can substantiate or refute claims of intrinsic magnetism in Co:ZnO. The authors show that specimens which meet the quality thresholds are devoid of secondary phases and then Co:ZnO films are paramagnetic. When changes in the preparation conditions promote the phase separations, then superparamagnetic behavior is observed. Utilizing XAS to relate magnetic properties with phase purity is a powerful

approach that can be used to other doped materials. The studies were performed at the ESRF beamline ID12 (Grenoble, France).

A. Ney, M. Opel, T.C. Kaspar, V. Ney, S. Ye, K. Ollefs, T. Kammermeier, S. Bauer, K.-W. Nielsen, S.T.B. Goennenwein, M.H. Engelhard, S. Zhou, K. Potzger, J. Simon, W. Mader, S.M. Heald, J.C. Cezar, F. Wilhelm, A. Rogalev, R. Gross, S.A. Chambers, "Advances spectroscopic synchrotron techniques to unravel the intrinsic properties of dilute magnetic oxides: The case of Co:ZnO," *New J. Phys.* 12 (2010) 013020-1-16. (EG)

#### Mechanism of Mo/Si multilayer damage

**(January 2010).** A multinational team of scientists from The Netherlands, Poland, Czech Republic, Germany, USA and UK has experimentally determined the process of damaging the multilayer optical elements during a single shot of the FLASH free electron laser (DESY, Hamburg, Germany).

A.R. Khorsand *et al.*, "Single shot damage mechanism of Mo/Si multilayer optics under intense pulsed XUV exposure," *Optics Express* 18 (2010) 700-712. (WP)

#### Usefulness of X-ray absorption spectroscopy in art conservation

**(January 2010).** The cultural heritage community commonly uses SR-XRF and SR-XRD, whereas the use of synchrotron-based X-ray absorption spectroscopy (SR-XAS) techniques remains marginal, mostly because cultural heritage specialists rarely interact with SR physicists. An international team (affiliations in France, Belgium and The Netherlands) examined the basic principles and capabilities of XAS techniques in art preservation. They emphasized, in particular, the chemical mapping capability of this technique, with high spatial resolution that provides information about local composition and chemical states, even for trace elements.

M. Cotte, J. Susini, J. Dik, K. Janssens, "Synchrotron-based X-ray absorption spectroscopy for art conservation: Looking back and looking forward," *Acc. Chem. Res.* 43 (2010) 705-714. (KLJ)

#### 3D version of Medipix detector tested at DIAMOND light source

**(February 2010).** The construction and results of tests (at the Diamond Light Source, UK) are presented for a new type of X-ray semiconductor area detector in a paper by a team of scientists affiliated in UK and Spain. The term "3D" concerns a column-like architecture of p-n diodes in a silicon sensor chip, which is connected to a Medipix2 readout chip. Its main advantage consists in low charge sharing between adjacent pixels.

D. Pennicard, J. Marchal, C. Fleta, G. Pellegrini, M. Lozano, C. Parkes, N. Tartoni, D. Barnett, I. Dolbnya, I. Sawhney, R. Bates, V. O'Shea, V. Wright, "Synchrotron tests of a 3D Medipix2 X-ray detector," *IEEE Trans. Nucl. Sci.* 57 (2010) 387-394. (AZ)

#### In-situ synchrotron study of green rust sulfate formation

**(February 2010).** "Green rust", is a complex iron hydroxide with physicochemical characteristics making it a material applicable in the domain of the pollution prevention and environmental waste treatment technologies, as it can be intercalated with various types of anions. Sulfate-ions-containing green rust is an important product of aqueous steel corrosion. A group of British scientists has applied X-ray scattering (WAXS) to experimentally determine the way of

formation of the green rust sulfate. Its complex formation path was studied using a computer-controlled chemical reactor mounted at the beamline. The knowledge of mechanism of green rust sulfate formation are of interest for understanding of the corrosion processes and provides key parameters that can tailor the production of green rust sulfate for industrial applications. The experiments were performed at MWP6.2 station of the Synchrotron Radiation Source (Daresbury Laboratory, U.K.) and at I22 station of Diamond Light Source (Oxford, U.K.).

I.A.M. Ahmed, L.G. Benning, G. Kakonyi, A.D. Sumoondur, N.J. Terrill, S. Shaw, "Formation of green rust sulfate: A combined *in situ* time-resolved X-ray scattering and electrochemical study," *Langmuir* 26 (2010) 6593-6603. (PP)

**Monitoring nitride layer growth (February 2010).** Real-time X-ray reciprocal space mapping was used by an American team to study the strain and composition distribution during metal-organic chemical vapor deposition of  $\text{In}_x\text{Ga}_{1-x}\text{N}$  on GaN. Authors demonstrate an interesting case of application of synchrotron radiation: they monitor the growth process through collecting a series of reciprocal space maps. In this way of *in-situ* observation of the process, the authors determined the progression of composition/strain inhomogeneity formation. The study was performed at the Advanced Photon Source (Argonne, USA).

M.-I. Richard, M.J. Highland, T.T. Fister, A. Munkholm, J. Mei, S.K. Streiffer, C. Thompson, P.H. Fuoss, G.B. Stephenson, "In-situ synchrotron x-ray studies of strain and composition evolution during metal-organic chemical vapor deposition of  $\text{InGaN}$ ," *Appl. Phys. Lett.* 96 (2010) 051911-1-3. (AW)

**Strain determination on wood exposed to bending (February 2010).** Researchers from Sweden and Switzerland determined the deformation of wood in the microscale. Three-point bending was applied to millimeter-sized samples under various loads. Cellular structure and strain field were determined for the applied loads. A nonelastic strain component was identified in the vicinity of the contact points. The experiments were performed at the Swiss Light Source (Villigen, Switzerland).

F. Forsberg, M. Sjö Dahl, R. Mooser, "Full three-dimensional strain measurements on wood exposed to three-point bending: analysis by use of digital volume correlation applied to synchrotron radiation micro-computed tomography image data," *Strain* 46 (2010) 47-60. (WP)

**Dental implant analysis using synchrotron high-resolution radiography (March 2010).** Micro-mechanical properties of dental implants strongly influence their durability. Scientists from Germany have determined fine details of implant-abutment interface of two-piece dental implants. Imaging of the mating zone of the implants during loading allowed for observation of the micro-gap formed between the two implant components. X-ray imaging experiments were carried out using a high energy beam (50 keV) at the BAMline of the BESSY-II synchrotron (Berlin, Germany).

A. Rack, T. Rack, M. Stiller, H. Riesemeier, S. Zabler, K. Nelson, "In vitro synchrotron-based radiography of micro-gap formation at the implant-abutment interface of two-piece dental implants," *J. Synchrotr. Radiat.* 17 (2010) 289-294. (WP)

**Single-pulse resonant magnetic scattering at FLASH (March 2010).** A collaboration between several institutes from Germany (from Hamburg, Berlin, Karlsruhe, Heidelberg and Remagen) ) resulted in demonstration of feasibility of the single-pulse resonant magnetic scattering experiments. The soft X-ray pulses used were generated by the FLASH FEL in Hamburg and a magnetic diffraction pattern from a Co/Pt multilayer sample at the  $\text{Co } M_{2,3}$  edge was recorded and analyzed.

C. Gutt, S. Streit-Nierobisch, L.-M. Stadler, B. Pfau, C. M. Günther, R. Könnecke, R. Frömter, A. Kobs, D. Stickler, H.P. Oepen, R.R. Fäustlin, R. Treusch, J. Feldhaus, E. Weckert, I.A. Vartanyants, M. Grunze, A. Rosenhahn, T. Wilhein, S. Eisebitt, G. Grübel, "Single-pulse resonant magnetic scattering using a soft x-ray free-electron laser," *Phys. Rev. B* 81 (2010) 100401-1-4. (WP)

**Soft X-ray diffraction under free-electron laser radiation demonstrated (March 2010).** A team of scientists affiliated in Germany has demonstrated the opportunity of investigation of soft X-ray (8 nm wavelength) diffraction in a single-shot mode (CFEL facility, Hamburg) for silver behenate nanocrystals exhibiting a lattice spacing of 5.8 nm.

I. Rajkovic, G. Busse, J. Hallmann, R. Moré, M. Petri, W. Quevedo, F. Krasniqi, A. Rudenko, T. Tschentscher, N. Stojanovic, S. Düsterer, R. Treusch, M. Tolkiel, S. Techert, "Diffraction properties of periodic lattices under free electron laser radiation", *Phys. Rev. Lett.* 104 (2010) 125503-1-4. (WP)

**$\text{Mg}_2\text{FeH}_6$ —synthesis and decomposition (April 2010).** Synthesis and decomposition of  $\text{Mg}_2\text{FeH}_6$ , a potential hydrogen-storage material were studied using X-ray diffraction at the MAX-lab synchrotron laboratory by a team of scientists from Poland, Sweden and Denmark. Formation of the title compound is found to consist of two steps.

M. Polanski, T.K. Nielsen, Y. Cerenius, J. Bystrzycki, T.R. Jensen, "Synthesis and decomposition mechanisms of  $\text{Mg}_2\text{FeH}_6$  studied by *in-situ* synchrotron X-ray diffraction and high-pressure DSC," *Int. J. Hydrogen Energy* 35 (2010) 3578-3582. (WP)

**New hydrogen storage materials – Ti-V-Cr alloy (April 2010).** Scientists from China show, using X-ray absorption spectroscopy and small-angle X-ray scattering synchrotron radiation based techniques, how local atomic order around Ti and V atoms changes after Ti-V-Cr. SAXS experiment indicated that nanoparticles' size increases after hydrogenation. The study has been performed at the Beijing Synchrotron Radiation Facility (BSRF) (Beijing, China).

C. Wan, X. Ju, Y. Qi, Y. Xin, J. Qiu, S. Wang, X. Liu, L. Jiang, "Synchrotron EXAFS and XRD studies of Ti-V-Cr hydrogen absorbing alloy," *Int. J. Hydrogen Energy* 35 (2010) 2915-2920. (MTK)

**Synchrotron X-ray diffraction supported by spectroscopic techniques reveals the pigments composition of Pompeian wall paintings (April & May 2010).** Scientists from France and Spain have determined the nature of pigments used in Pompeian-wall paintings. Using high-resolution powder diffraction at a synchrotron beamline allowed for identification of pigment components of weight as low as several micrograms. Numerous phases have been identified and evidences for the use of organic binders have been demonstrated. The synchrotron diffraction technique is destructive at the microgram level but it is demonstrated to be more sensitive to minority phases. BM25A beamline (ESRF,

Grenoble, France) was used in the present study for diffraction data collection.

A. Duran, M.C. Jimenez De Haro, J.L. Perez-Rodriguez, M.L. Franquelo, L.K. Herrera, A. Justo, "Determination of pigments and binders in Pompeian wall paintings using synchrotron radiation – high-resolution x-ray powder diffraction and conventional spectroscopy – chromatography," *Archaeometry* 52 (April 2010) 286–307; A. Duran, J. Castaing, P. Walter, "X-ray diffraction studies of Pompeian wall paintings using synchrotron radiation and dedicated laboratory made systems," *Appl. Phys. A: Mater. Sci. Process.* 99 (May 2010) 333-340. (WP)

**Chemistry of *Archaeopteryx* (May 2010).** A collaboration between American and British scientists resulted in the first detailed chemical analysis of *Archaeopteryx* (*Theropos Archaeopteryx*). The technique termed synchrotron rapid scanning X-ray fluorescence (SRS-XRF) developed at the Stanford Synchrotron Radiation Lightsource (SSRL) was used. It permits to rapidly scan the given (large) object and determine, at each point, the content of trace elements at concentration levels of parts per million. Distribution of the bone and feather elements has been determined in detail and analyzed. SRS-XRF imaging is concluded to be a powerful development in the geological and biological sciences.

U. Bergmann, R.W. Morton, P.L. Manning, W.I. Sellers, S. Farrar, K.G. Huntley, R.A. Wogelius, P. Larson, "Archaeopteryx feathers and bone chemistry fully revealed via synchrotron imaging," *PNAS* 107 (2010) 9060-9065. (WP)

**Highest-quality X-ray mirrors for synchrotron applications (May 2010).** Scientists from Germany in collaboration with Carl Zeiss Laser Optics GmbH implemented powerful measuring and manufacturing techniques for the generation of highest quality optical components for synchrotron radiation applications, especially those of conical sections geometries used for collimation or focusing.

H. Thiess, H. Lasser, F. Siewert, "Fabrication of X-ray mirrors for synchrotron applications," *Nucl. Instr. Meth. Phys. Res. A* 616 (2010) 157-161. (RS)

**New synchrotron laboratory for micro and nano devices (May 2010).** The authors discuss the overall beamline concept of SyLMAND, the Synchrotron Laboratory for Micro and Nano Devices at the Canadian Light Source storage ring (Saskatoon, Canada). SyLMAND is a new deep X-ray lithography facility focusing on spectral and beam power adjustability and large exposable area formats. The beam power can be adjusted between 0.1 and 261 W, while photon energies between 1 and 15 keV can be achieved. The facility is currently getting finished. It will add unique spectral and beam power capabilities at large exposure formats to the scientific community.

S. Achenbach, V. Subramanian, D. Klymyshyn, G. Wells, "Synchrotron laboratory for micro- and nanodevices: Facility concept and design," *Microsyst. Technol.* 16 (2010) 1293-1298. (EG)

**Synchrotron-based FTIR spectra of stained single cells: Towards a clinical application in pathology (May 2010).**

Authors from UK, Norway and France have shown the use of FTIR spectroscopy at SOLEIL synchrotron facility (Saint-Aubin, France) as a potential analytical method in tissue and

cell studies aimed for cancer diagnosis. Their findings open a way towards clinical applications of FTIR such as a tool that would scan samples to assess the presence or absence of malignant cells in biopsies, or as an aid to help pathologists to better characterize those cells that are suspicious but not diagnostic for cancer. These revolutionary applications are described in a highly ranked *Laboratory Investigation* journal. J. Pijanka, G.D. Sockalingum, A. Kohler, Y. Yang, F. Draux, G. Parkes, K.-P. Lam, D. Collins, P. Dumas, C. Sandt, D.G. van Pittius, G. Douce, M. Manfait, V. Untereiner, J. Sulé-Suso, Models and techniques synchrotron-based FTIR spectra of stained single cells. Towards a clinical application in pathology, *Lab. Investig.* 90 (2010) 797-807. (WMK)

**The structure of D-ribose solved (May 2010).** The structure of crystalline D-ribose has remained unknown up until now. With its 20 main scattering centers in the asymmetric unit, solving the D-ribose crystal structure represents a challenge for powder diffraction methods. Scientists from Switzerland and Germany solved the crystal structure of D-ribose using synchrotron powder diffraction (data collected at Materials Science Beamline at the Swiss Light Source, Villigen, Switzerland) combined with nuclear magnetic resonance.

D. Šišak, L.B. McCusker, G. Zandomenghi, B.H. Meier, D. Bläser, R. Boese, W.B. Schweizer, R. Gilmour, J.D. Dunitz "The crystal structure of D-Ribose—at last!," *Angew. Chem. Int. Ed.* 49 (2010) 4503-4505. (PP)

**XRD and XAS monitoring of batteries during operation (May 2010).** Scientists from France designed a new electrochemical special cell for *operando* experiments for X-ray diffraction and X-ray absorption at synchrotron facilities. It allows for the investigation of insertion materials under high current densities (up to 5C rate) and hence to study complex phenomena of structural and electronic changes out of equilibrium. The LiFePO<sub>4</sub>-FePO<sub>4</sub> system was chosen as a case study to validate this cell. In particular, for this system the phenomenon of apparent delays in phase formation compared with the number of electrons exchanged, was reported. The studies were performed at the synchrotron SOLEIL, France.

J.B. Leriche, S. Hamelet, J. Shu, M. Morcrette, C. Masquelier, G. Ouvrard, M. Zerrouki, P. Soudan, S. Belin, E. Elkaïm, F. Baudalet, "An electrochemical cell for *operando* study of lithium batteries using synchrotron radiation," *J. Electrochem. Soc.* 157 (2010) A606-A610. (KLJ)

**Elastic deformation of dentin (June 2010).** Dentin has a complex microstructure: it is built from hydroxyapatite nanoplatelets within a compliant collagen matrix. Its elastic properties depend on the distribution and size of the platelets. The Young modulus of the dentine is found to be much lower than that of the bulk hydroxyapatite. The study was carried out at the 2-BM beamline of the Advanced Photon Source (APS), Argonne, USA.

A.C. Deymier-Black, J.D. Almer, S.R. Stock, D.R. Haefner, D.C. Dunand, "Synchrotron X-ray diffraction study of load partitioning during elastic deformation of bovine dentin," *Acta Biomaterialia* 6 (2010) 2172-2180. (WP)

**Synchrotron at the service of analytical chemistry (June 2010).** A legendary racehorse, Phar Lap, died of arsenic poisoning in 1932. The researchers from Australia and

Taiwan confirm that the animal died of arsenic poisoning. They only examined hairs that were unquestionably still growing at the time of death. These were individually analyzed along their entire length with synchrotron X-ray fluorescence spectroscopy, at the Advanced Photon Source (Argonne, US).

I.M. Kempson, D.A. Henry "Determination of arsenic poisoning and metabolism in hair by synchrotron radiation: The case of Phar Lap," *Angew. Chem. Int. Ed.* 49 (2010) 4237-4240. (PP)

**A synchrotron study shows that washing rice removes the trace toxic elements (July 2010).** A team of scientists from Hungary, Belgium and China has used synchrotron radiation (DORIS III synchrotron ring, HASYLAB DESY, Hamburg, Germany) to determine the heavy metal content in rice and discussed the ways of removing these metals from the food. The results show that attention has to be paid for the preparation of rice dishes in a specific way may strongly reduce the amount of toxic elements such as arsenic and cadmium concentrating in the near-surface region.

V.G. Mihucz, G. Silversmit, I. Szalóki, B. de Samber, T. Schoonjans, E. Tatár, L. Vincze, I. Virág, J. Yao, G. Záray, "Removal of some elements from washed and cooked rice studied by inductively coupled plasma mass spectrometry and synchrotron based confocal micro-X-ray fluorescence," *Food Chem.* 121 (2010) 290-297. (WP)

**Tumor cell response to synchrotron microbeam radiation therapy differs markedly from cells in normal tissues (July 2010).** Scientists from Australia describe the use of high-dose synchrotron radiation (SR) for microbeam radiation therapy (MRT). They claim the high-dose SR can be effective at destroying tumors in animal models while causing very little damage to normal tissues. Their observations seem to be very important in terms of potential clinical application.

J.C. Crosbie, R.L. Anderson, K. Rothkamm, C.M. Restall, L. Cann, S. Ruwanpura, S. Meachem, N. Yagi, I. Svalbe, R.A. Lewis, B.R.G. Williams, P.A.W. Rogers, "Tumor cell response to synchrotron microbeam radiation therapy differs markedly from cells in normal tissues," *Int. J. Radiat. Oncol. Biol. Phys.* 77 (2010) 886-894. (WMK)

**X-ray free electron laser operating at wavelengths down to 1.2 Å (August 2010).** A large American group (from Stanford, Livermore and Argonne) has reported lasing and operation at a XFEL in the SLAC National Accelerator Laboratory. The pulse duration achieved was less than 10 fs.

P. Emma, R. Akre, J. Arthur, R. Bionta, C. Bostedt, J. Bozek, A. Brachmann, P. Bucksbaum, R. Coffee, F.-J. Decker, Y. Ding, D. Dowell, S. Edstrom, A. Fisher, J. Frisch, S. Gilevich, J. Hastings, G. Hays, Ph. Hering, Z. Huang, R. Iverson, H. Loos, M. Messerschmidt, A. Miahnahri, S. Moeller, H.-D. Nuhn, G. Pile, D. Ratner, J. Rzepiela, D. Schultz, T. Smith, P. Stefan, H. Tompkins, J. Turner, J. Welch, W. White, J. Wu, G. Yocky, J. Galayda, "First lasing and operation of an ångstrom-wavelength free-electron laser," *Nature Photonics* 4 (2010) 641-647. (WP)

**EXAFS in core/shell-nanoparticles studies (September 2010).** Scientists from UK demonstrate that EXAFS is useful for studies of the atomic structure in core/shell nanoparticles, on the example of Fe/Cu and Fe/Au core/shell nanoparticles. It was clear from the Fe/Cu results that if the purpose (or one of the purposes) of the shell is to affect a change in the atomic structure of the core, to obtain higher atomic moments for

example, the shell should be thick enough to achieve this. Both the Fe/Cu and the Fe/Au results show that in thin shells, 1–2 monolayers thick, there is a considerable contraction in the interatomic distances compared with those in the corresponding bulk materials. The measurements were performed on at the European Synchrotron Radiation Facility (ESRF) at Grenoble and at DIAMOND Light Source (UK).

S.H. Baker, M. Roy, S.C. Thornton, M. Qureshi, C. Binns, "Probing atomic structure in magnetic core/shell nanoparticles using synchrotron radiation," *J. Phys.: Condens. Matt.* 22 (2010) 385301-1-11. (KLJ)

**Pigments of ancient paintings from Northern Patagonia (September 2010).** Scientists from Argentina, Belgium and Venezuela determined the nature of pigments from prehistoric paintings discovered in Carriqueo rock shelter (Neuquén, Argentina). The phase analysis revealed the presence of haematite, goethite, kaolinite, and quartz as components of the pigments. A source of provenance of these materials was discussed. The diffraction data were collected at Brazilian Synchrotron Light Source. Campinas, Brazil.

C. Vázquez, O.M. Palacios, L. Darchuk, L.-M. Marcó Parra, "Compositional study of prehistoric pigments (Carriqueo rock shelter, Argentina) by synchrotron radiation X-ray diffraction," *Powder Diffrac.* 25 (2010) 264-269. (WP)

**Synchrotron X-ray diffraction applied to study the quality of heteroepitaxial ZnO films (September 2010).** Heteroepitaxial ZnO films grown on GaN and Al<sub>2</sub>O<sub>3</sub> substrates have been studied by Synchrotron X-ray Diffraction (SXRD). The ZnO film grown on GaN-buffered C-Al<sub>2</sub>O<sub>3</sub> showed no strains and the narrowest mosaic distribution. The measurements were performed at beamline 5C2 at the Pohang Light Source (Korea).

J.Y. Park, J.H. Je, S.S. Kim, "Synchrotron X-ray diffraction studies of heteroepitaxial ZnO films grown by pulsed laser deposition," *J. Cryst. Growth* 312 (2010) 3588-3591. (EG)

**Controlling of Pd and Pt nanoparticles applicable in catalysis (October 2010).** Authors from New Zealand survey the different approaches in solution-phase synthesis to obtain shaped platinum and palladium nanoparticles. Catalytic studies of the shaped nanoparticles showing enhanced activity and selectivity are highlighted. The study is based mostly on TEM experiments but also on *in-situ* XRD measurements at Australian Synchrotron (Melbourne).

S. Cheong, J.D. Watt, R.D. Tilley, "Shape control of platinum and palladium nanoparticles for catalysis," *Nanoscale* 2 (2010) 2045-2053. (ZK)

**Table-top femtosecond hard X-ray source: Laser-driven plasma accelerators (October 2010).** Scientists from UK, USA, Portugal and France demonstrate, that the use of a new generation of laser-driven plasma accelerators leads to directional, spatially coherent, intrinsically ultrafast beams of hard X-rays. This reduces the size of the synchrotron source from the tens of metres to the centimetre scale, simultaneously accelerating and wiggling the electron beam. Stability and resolution tests as well as single shot radiographic images are shown. The study has been performed at the Center for Ultrafast Optical Science, University of Michigan (Ann Arbor, USA).

S. Kneip, C. McGuffey, J.L. Martins, S.F. Martins, C. Bellei, V. Chvykov, F. Dollar, R. Fonseca, C. Huntington, G. Kalintchenko, A. Maksimchuk, S.P.D. Mangles, T. Matsuoka, S.R. Nagel, C.A.J. Palmer, J. Schreiber, K. Ta Phuoc, A.G.R. Thomas, V. Yanovsky, L.O. Silva, K. Krushelnick, Z. Najmudin, "Bright spatially coherent synchrotron X-rays from a table-top source," *Nature Phys.* 6 (2010) 980-983, correction 7 (2011) 737. (MS)

**Application of *in-situ* growth techniques to monitor growth of ZnO (November 2010).** A combination of X-ray reflectivity and X-ray fluorescence has been applied by an American group to monitor first stages of growth of ZnO film on Si substrate by atomic layer deposition. It was demonstrated that initially amorphous ZnO islands grow on the native oxide with the onset of coalescence occurring during the next stage. The method may provide a deeper insight in future studies of the growth process of more complex material. The experiments were carried out at Sector 12ID-B of the Advanced Photon Source (Argonne, USA).

D.D. Fong, J.A. Eastman, S.K. Kim, T.T. Fister, M.J. Highland, P.M. Baldo, P.H. Fuoss, "In situ synchrotron X-ray characterization of ZnO atomic layer deposition," *Appl. Phys. Lett.* 97 (2010) 191904-1-3. (EG)

**Towards control of radionuclide migration in nuclear waste repositories (November 2010).** Scientists from China present a review of studies of the lanthanides/actinides sorption speciation on minerals and oxides performed by the time resolved laser fluorescence spectroscopy (TRLFS), extended X-ray absorption fine structure spectroscopy (EXAFS) and density functional theory (DFT). This kind of study is very important for the field of nuclear disposal safety research. The interaction of lanthanides/actinides with oxides and minerals as well as their uptake are also of common interest in radionuclide chemistry. The review is a key to understanding of the physicochemical behavior of lanthanides/actinides at a molecular level in the natural environment.

X. Tan, M. Fang, X. Wang, "Sorption speciation of lanthanides/actinides on minerals by TRLFS, EXAFS and DFT studies: a review," *Molecules* 15 (2010) 8431-8468. (KLJ)

**A bright table-top X-ray source (December 2010).** In recent years, increasingly concentrated efforts, both in theory and experiment, have been devoted to develop efficient methods of charged particle acceleration with plasma wake fields that reduce to the centimetre scale, distances to reach GeV electron energies. The progress achieved in the field makes the desk-top solutions feasible and potentially highly competitive with 'conventional' large-scale facilities, like storage ring synchrotrons and linac free electron lasers as the short wave-length synchrotron radiation sources. The broad international collaboration lead to a report on promising results achieved in experiments carried out at the University of Michigan with a new generation of laser-driven plasma accelerator which, exploiting extreme nonlinear interactions, accelerates high-charge electron beams to high energy at short distances, to produce directional, spatially coherent, intrinsically ultrafast beams of hard X-rays.

S. Kneip, C. McGuffey, J.L. Martins, S.F. Martins, C. Bellei, V. Chvykov, F. Dollar, R. Fonseca, C. Huntington, G. Kalintchenko, A. Maksimchuk, S.P.D. Mangles, T. Matsuoka, S.R. Nagel, C.A.J. Palmer, J. Schreiber, K. Ta Phuoc, A.G.R. Thomas, V. Yanovsky,

L.O. Silva, K. Krushelnick, Z. Najmudin, "Bright spatially coherent synchrotron X-rays from a table-top source," *Nature Phys.* 6 (2010) 980-983. (EAG)

**Review of hard and soft X-ray microscopy and tomography techniques applicable in catalysis (December 2010).** Scientists from review X-ray microscopy and tomography techniques with micrometre resolution but also the possibility to follow structural changes in the sub-100 nm regime of heterogeneous catalysts. X-ray microscopy as well as coherent X-ray diffraction imaging techniques are described together with the challenging design of suitable environmental cells. Examples are based on measurements at ESRF (Grenoble, France), Advanced Photon Source (Chicago, USA), ANKA (Karlsruhe, Germany), and HASYLAB (Hamburg, Germany).

J.-D. Grunwaldt, C.G. Schroer, "Hard and soft X-ray microscopy and tomography in catalysis: bridging the different time and length scales," *Chem. Soc. Rev.* 39 (2010) 4741-4753. (ZK)

**Synchrotron radiation imaging techniques allow for visualisation of catalytic solids (December 2010).** Authors from Debye Institute for NanoMaterials Science, Utrecht, Netherlands review the chemical-imaging techniques useful in heterogeneous catalysis, available on synchrotron for a long range of world synchrotrons. Encompasses spectroscopy, microscopy, tomography and various imaging techniques of different spatial resolution with catalytical examples. Exemplary data have been measured on a range of synchrotrons (BESSY, HASYLAB, ESRF etc), future prospects discuss the use of FEL facilities.

A.M. Beale, S.D.M. Jacques, B.M. Weckhuysen, "Chemical imaging of catalytic solids with synchrotron radiation," *Chem. Soc. Rev.* 39 (2010) 4656-4672. (ZK)

**2D electron gas at the SrTiO<sub>3</sub> surface ((January 2011).** Properties of the two-dimensional electron gas at the surface of SrTiO<sub>3</sub>, a material applicable in electronics, have been determined by a big team (affiliations in France, USA, Germany, Argentina, Spain and China) using angle-resolved photoemission spectroscopy at the Synchrotron Radiation Center (University of Wisconsin-Madison) and at the Synchrotron SOLEIL (France),

A.F. Santander-Syro, O. Copie, T. Kondo, F. Fortuna, S. Pailhès, R. Weht, X.G. Qiu, F. Bertran, A. Nicolaou, A. Taleb-Ibrahimi, P. Le Fèvre, G. Herranz, M. Bibes, N. Reyren, Y. Apertet, P. Lecoeur, A. Barthélémy, M.J. Rozenberg, "Two-dimensional electron gas with universal subbands at the surface of SrTiO<sub>3</sub>," *Nature* 469 (2011) 189-194. (WP)

**ALD chamber for in-situ synchrotron X-ray scattering study of film growth (February 2011).** Monitoring of the layer growth by ALD can be achieved through synchrotron X-ray reflectivity and two-dimensional grazing-incidence X-ray diffraction measurements. The work has been completed by a Korean team at the Korean light source in Pohang.

Y.J. Park, D.R. Lee, H.H. Lee, H.B. Lee, H. Kim, G.C. Park, S.W. Rhee, S. Baik, "In-situ synchrotron X-ray scattering study of thin film growth by atomic layer deposition," *J. Nanosci. Nanotechnol.* 11(2) (2011) 1577-1580. (WP)

**New, promising method for protein structure determination at hard-X-ray free-electron laser (February 2011).** A multinational team led by H.N. Chapman presents

experimental results validating a completely new method for structure determination of macromolecules that do not yield crystals of sufficient size for studies using conventional radiation sources or are particularly sensitive to radiation damage. Single-crystal X-ray diffraction ‘snapshots’ were collected from a fully hydrated stream of nanocrystals using femtosecond pulses from a hard-X-ray free-electron laser, the Linac Coherent Light Source.

H.N. Chapman *et al.* "Femtosecond X-ray protein nanocrystallography," *Nature* 470 (2011) 73-78. (RS)

**Why yellow Sunflowers in the paintings by van Gogh are darkening? (February 2011).** To answer this questions an international team of researchers under the leadership of Koen Janssens and Joris Dik studied the darkening phenomenon applying synchrotron-radiation high-lateral-resolution spectroscopic techniques such as: microscopic X-ray absorption near edge ( $\mu$ -XANES), X-ray fluorescence spectrometry ( $\mu$ -XRF), micro-Raman and mid-FTIR analyses. Investigations carried out on the pigment samples prepared in the laboratory as well as on the micro-samples taken from original two paintings by Vincent van Gogh revealed that darkening of the yellow pigment (chrome yellow) is caused by reduction of  $\text{PbCrO}_4$  to  $\text{Cr}_2\text{O}_3 \cdot 2\text{H}_2\text{O}$ , likely accompanied by the presence of other Cr(III) compounds.

L. Monico, G. Van der Snickt, K. Janssens, W. De Nolf, C. Miliani, J. Dik, M. Radepon, E. Hendriks, M. Geldof, M. Cotte, "Degradation process of lead chromate in paintings by Vincent van Gogh studied by means of synchrotron X-ray spectromicroscopy and related methods. 2. Original paint layer samples," *Anal. Chem.* 83 (2011) 1224-1231. (ARL)

**Improved FTIR microspectroscopy based imaging technique (March 2011).** An American group has developed a FTIR imaging multiple-beam technique characterized by high resolution, good chemical sensitivity and high acquisition speed. Examples of application for biological samples are demonstrated. The experiments were performed at Synchrotron Radiation Center, Univ. of Wisconsin-Madison.

M.J. Nasse, M.J. Walsh, E.C. Mattson, R. Reininger, A. Kajdacsy-Balla, V. Macias, R. Bhargava, C.J. Hirschmugl, "High-resolution Fourier-transform infrared chemical imaging with multiple synchrotron beams", *Nature Methods* (2011) 413-416. (WP)

**Lithium metal at non-ambient conditions (March 2011).** A team of scientists affiliated in UK, France and US has determined the structures of lithium metal submitted to high pressure (up to 130 GPa) and low temperature conditions (77-300 K). The study, performed at ID-09 beamline at the ESRF and 16-ID-B (HPCAT) beamline at the APS (USA) was a challenge because of the weak signal due to the weak scattering of lithium ions. A  $p$ - $T$  phase diagram combining the existing data is proposed.

C.L. Guillaume, E. Gregoryanz, O. Degtyareva, M.I. McMahon, M. Hanfland, S. Evans, M. Guthrie, S.V. Sinogeikin, H.-K. Mao, "Cold melting and solid structures of dense lithium," *Nature Phys.* 7 (2011) 211-214. (WP)

**Test experiments on silicon melting process at extreme conditions (March 2011).** Ultrafast pump and probe experiments in the 0.1–10 ps range on silicon melting [rocess have been performed by a French-Italian group at the TIMEX endstation of the FERMI free electron laser (Basovizza/Trieste, Italy). Evolution of the optical properties of the material in the picosecond scale is described. The current and future status of the endstation is discussed.

A. Di Cicco, F. D'Amico, G. Zgrablic, E. Principi, R. Gunnella, F. Bencivenga, C. Svetina, C. Masciovecchio, F. Parmigiani, A. Filipponi, "Probing phase transitions under extreme conditions by ultrafast techniques: Advances at the Fermi@Elettra free-electron-laser facility," *J. Non-Cryst. Solids* 357 (2011) 2641-2647. (WP)

**Time-resolved photoelectron spectroscopy at SOLEIL (March 2011).** A new two-dimensional delay-line detector tested at the SOLEIL synchrotron having a time resolution of 5 ns was installed on a Scienta SES 2002 electron energy analyzer. It replaced the CCD camera-based two dimensional detection of electron energy analyzers and was adapted to the time structure of the SOLEIL synchrotron. Its first application was a characterization of the time of flight of the photoemitted electrons as a function of their kinetic energy and the selected pass energy. By repeating the experiment as a function of the available pass energy and of the kinetic energy, a complete characterization of the analyzer behavior in the time domain has been obtained. Now, one can perform the pump-probe photoelectron spectroscopy experiments with the time resolution given by the SOLEIL pulse width.

N. Bergeard, M.G. Silly, D. Krizmancic, C. Chauvet, M. Guzzo, J.P. Ricaud, M. Izquierdo, L. Stebel, P. Pittana, R. Sergo, G. Cautero, G. Dufour, F. Rochet, F. Sirotti, "Time-resolved photoelectron spectroscopy using synchrotron radiation time structure," *J. Synchrotr. Radiat.* 18 (2011) 245-250. (KLJ)

**Weak itinerant ferromagnetism develops during dimer breaking (March 2011).** X-ray diffraction experiments performed by Scientists from Princeton University and Argonne Natl. Lab. (USA) at Advanced Photon Source beam line 11-BM on  $\text{SrCo}_2(\text{Ge}_{1-x}\text{P}_x)_2$ , followed by structure refinement, demonstrate that during dimer breaking, weak itinerant ferromagnetism develops. The chemical bond breaking as a tuning parameter to induce a quantum critical point can be helpful in design and studies of novel magnetic materials.

S. Jia, P. Jiramongkolchai, M.R. Suhomel, B.H. Toby, J.G. Checkelsky, N.P. Ong, R.J. Cava, "Ferromagnetic quantum critical point induced by dimer-breaking in  $\text{SrCo}_2(\text{Ge}_{1-x}\text{P}_x)_2$ ," *Nature Phys.* 7 (2011) 207-210. (WP)

**X-ray fluorescence detection free of self-absorption (March 2011).** Scientists from Canada demonstrate that the X-ray emission from any element that is not resonant with the absorption edge under investigation can be used for registration of the absorption edge and the measured signal is free from self-absorption. It was found that the inverse of such partial fluorescence yield (PFY) is linearly proportional to the X-ray absorption cross-section without any correction due to saturation or self-absorption. Their term this technique *inverse partial fluorescence yield* (IPFY). This technique was demonstrated by measuring O  $K_{\alpha}$  PFY from high- $T_c$  cuprate

LNSCO when scanning the Cu L<sub>2,3</sub> edge and Nd M<sub>4,5</sub> edge. The studies were performed at Canadian Light Source.

A.J. Achkar, T.Z. Regier, H. Wadati, Y.-J. Kim, H. Zhang, D.G. Hawthorn, "Bulk sensitive X-ray absorption spectroscopy free of self-absorption effects," *Phys. Rev. B* 83 (2011) 081106(R)-1-4. (KLJ)

**Iron pnictide superconductor: All hands on deck! (April 2011).** One synchrotron is not enough. Scientists from China and U.S. provided the key structural information in understanding the origin of the pressure dependence of superconducting transition temperature ( $T_c$ ) for 111-type iron pnictide superconductors. The effect of pressure on the crystalline structure and  $T_c$  of the 111-type Na<sub>1-x</sub>FeAs system using in-situ high-pressure synchrotron X-ray powder diffraction and diamond anvil cell techniques was studied at Advanced Photon Source, Argonne National Laboratory (Argonne, United States) and at National Synchrotron Light Source (Brookhaven National Laboratory, Upton, NY, United States).

Q. Liu, X. Yu, X. Wang, Z. Deng, Y. Lv, J. Zhu, S. Zhang, H. Liu, W. Yang, L. Wang, H. Mao, G. Shen, Z.-Y. Lu, Y. Ren, Z. Chen, Z. Lin, Y. Zhao, C. Jin, "Pressure-induced isostructural phase transition and correlation of FeAs coordination with the superconducting properties of 111-type Na<sub>1-x</sub>FeAs," *J. Am. Chem. Soc.* 133 (2011) 7892-7896. (PP)

**Solid-to-plasma transition and atomic order decay studied at FLASH free electron laser (April 2011).** Researchers from eight countries (France, UK, Pakistan, USA, Germany, The Netherlands, Poland, and Czech Republic) have determined variation of atomic order after fast irradiation of aluminium foil by the femtosecond pulse of FLASH free-electron laser, and properties and evolution of plasma created by irradiation.

E. Galtier *et al.*, "Decay of crystalline order and equilibration during the solid-to-plasma transition induced by 20-fs microfocused 92-eV free-electron-laser pulses," *Phys. Rev. Lett.* 106 (2011) 164801-1-4. (WP)

**Combined X-ray microscopy and electron microscopies used for determination of architecture of corals (on line May 2011).** Collaboration between eight French, Canadian, Polish and American institutes resulted in a study of the aragonite crystallites orientation and distribution in corals. The obtained data provide information on the nanometer-scale processes leading to biomineral formation. The X-ray microscopy experiments were performed at Stanford Synchrotron Radiation Light Source (Stanford, USA).

K. Benzerara, N. Menguy, M. Obst, J.L. Stolarski, M. Mazur, T. Tyliczszak, G.E. Brown Jr., A. Meibom, "Study of the crystallographic architecture of corals at the nanoscale by scanning transmission X-ray microscopy and transmission electron microscopy," *Ultramicroscopy* (2011), in print. (WP)

**X-ray absorption microbeam studies of a diluted magnetic semiconductor (May 2011).** International group of scientists reported results of studies of the local atomic structure of highly homogeneous Ga<sub>1-x</sub>Mn<sub>x</sub>N alloy films (0.03 <  $x$  < 0.09) by means of Mn and Ga  $K$ -edge extended X-ray absorption fine structure (EXAFS) measurements. In the studied films, grown by molecular beam epitaxy, the Mn atoms are in tetrahedral configuration, independently of the

Mn concentration. A small increase in the interatomic distances is observed with increasing Mn content. The Debye-Waller factor does not show a significant trend as Mn content increases. This finding suggests the presence of short-range disorder in the GaN lattice. *Ab-initio* calculations of the structural parameters for two different Mn concentrations are consistent with the experimental results. The measurements were carried out at the soft and hard X-ray microprobes, beam lines ID21 and ID22, of the European Synchrotron Radiation Facility (ESRF).

O. Sancho-Juan, O. Martinez-Criado, A. Cantarero, N. Garro, M. Salom, J. Susini, D. Olguin, S. Dhar, K. Ploog, "Extended X-ray absorption fine structure in Ga<sub>1-x</sub>Mn<sub>x</sub>N/SiC films with high Mn content," *Phys. Rev. B* 83 (2011) 172103-1-4. (KLJ)

**Elemental analysis may help in brain-tumor classification (on line July 2011).** A team from AGH University of Technology (Cracow, Poland) has studied various types of brain tumors (glioblastoma multiforme, gemistocytic astrocytoma, oligodendroglioma, anaplastic oligodendroglioma, ganglioglioma, fibrillary astrocytoma, and atypical transitional meningioma). using X-ray fluorescence. The results indicate that studies of elemental tissue composition focused on some specific elements may be helpful in classification of brain tumors.

M. Szczerbowska-Boruchowska, M. Lankosz, D. Adamek, "First step toward the "fingerprinting" of brain tumors based on synchrotron radiation X-ray fluorescence and multiple discriminant analysis," *J. Biol. Inorg. Chem.* (on line July 3, 2011), in print. (WP)

**Inkjet printing technique developed for producing organic semiconducting films (July 2011).** Collaboration of researchers from three Japanese institutions led to development of a method of single-crystalline organic semiconductor deposition through the inkjet printing process. X-ray diffraction at Photon Factory synchrotron (Tsukuba, Japan) was used to prove the good film quality. An important element of the method is the development of special functional ink containing the given semiconductor. The elaborated method can be considered as worth considering for future production of cheap electronic devices. This method provides a new useful way of fabrication of transistor arrays on top of plastic substrates, permitting to create large-area, light-weight and high-speed electronic products.

H. Minemawari, T. Yamada, H. Matsui, J. Tsutsumi, S. Haas, R. Chiba, R. Kumai, T. Hasegawa, "Inkjet printing of single-crystal films," *Nature* 475 (2011) 364-367. (WP)

**New view of magnetic domains: Diffraction of linearly polarized X-rays (July 2011).** Scientists from USA, UK, Germany and France report the proof-of-principle experiment of iterative phase retrieval from magnetic X-ray diffraction with a spatial resolution of about 75 nm. An experiment performed on amorphous terbium-cobalt thin film showed that resonant excitation and coherent scattering of linearly polarized soft X-rays can be used to image both the amplitude and the phase of magnetic domain structures on nanometer scale. The study has been performed at Advanced Light Source (Berkeley, USA).

J.J. Turner, X. Huang, O. Krupin, K.A. Seu, D. Parks, S. Kevan, E. Lima, K. Kisslinger, I. McNulty, R. Gambino, S. Mangin, S. Roy, P. Fischer, "X-ray diffraction microscopy of magnetic structures," *Phys. Rev. Lett.* 107 (2011) 033904-1-4. (MS)

**A model of absorption background for the practical EXAFS analysis (July 2011).** The application of the atomic absorption signal as a proper EXAFS background is demonstrated and discussed in the analysis of Ba hexaferrite nanoparticles with a very weak structural signal. The essential gain is found in the decrease of uncertainty intervals of structural parameters and their correlations. A simple analytical model of the calculation of the absorption background for the practical EXAFS analysis is demonstrated.

J. Padeznik Gomilek, A. Kodre, I. Arcon, S. de Panfilis, D. Makovec, "Atomic absorption background of Ba in EXAFS analysis of BaFe<sub>12</sub>O<sub>19</sub> nanoparticles," *J. Synchrotr. Radiat.* 18 (2011) 557-563. (KLJ)

**X-ray diffraction and absorption study of (Ga,Mn)N (July 2011).** In an experimental study of (Ga,Mn)N, collaborating researchers from Austria, Poland and France have used various techniques including synchrotron high-resolution X-ray diffraction, EXAFS and XANES, which helped in verifying predictions concerning the ferromagnetism in dilute magnetic insulators and to demonstrate that the interaction changes from ferromagnetic to antiferromagnetic when the charge state of the Mn<sup>3+</sup> is reduced to Mn<sup>2+</sup>.

A. Bonanni, M. Sawicki, T. Devillers, W. Stefanowicz, B. Faina, T. Li, T.E. Winkler, D. Szentkiel, A. Navarro-Quezada, M. Rovezzi, R. Jakiela, A. Grois, M. Wegscheider, W. Jantsch, J. Suffczyński, F. D'Acapito, A. Meingast, G. Kothleitner, T. Dietl, "Experimental probing of exchange interactions between localized spins in the dilute magnetic insulator (Ga,Mn)N," *Phys. Rev. B* 84 (2011) 035206-1-11. (WP)

**Semiconductor area detector for experiments at free electron lasers (September 2011).** The prototype semiconductor area detector (194x185 pixels, 110x110 micrometer pixel size) for FEL experiments is described in a paper by scientists affiliated in US. It is able to handle high flux rates and continuous frames rates exceeding 120 Hz. Information on plans of further developments is provided. The detector was tested at LCLS light source Linac Coherent Light Source (Menlo Park, USA).

H.T. Philipp, M. Hromalik, M. Tate, L. Koerner, S.M. Gruner, "Pixel array detector for X-ray free electron laser experiments", *Nucl. Instrum. Meth. Phys. Res. A* 649 (2011) 67-69. (AZ)

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*News in the above section were prepared by:*

E. Guziewicz (EG), K. Ławniczak-Jablonska (KLJ), M.T. Klepka (MTK), W. Paszkowicz (WP), R. Sobierajski (RS), and A. Wierzbicka (AW) (Institute of Physics PAS, Warsaw), Z. Kaszkar (ZK) (Institute of Physical Chemistry PAS, Warsaw), W. Kwiatek (WK) (Institute of Nuclear Physics PAS, Cracow), M. Sikora (MS) and A. Zięba (AZ) (AGH University of Technology, Cracow), E.A. Gorlich (EAG) and A. Rafalska-Łasocha (ARL) (Jagellonian University, Cracow), P. Piszora (PP) (Adam Mickiewicz University, Poznań).

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## NEW MACHINES & BEAMLINES. OTHER EVENTS

**New diffraction-oriented beamline at ELETTRA (2010).** The new beamline, MCX, at the Italian synchrotron Elettra in Trieste is devoted to the X-ray diffraction stress and texture analysis of thin films and surfaces.

**New SAXS beamline at MAXlab (2011).** A new SAXS beamline, 911-4, at MAX-lab (Lund, Sweden) allows for SAXS studies with high (a few nm) resolution.

**SOLARIS (first synchrotron light source in Poland): Design and ground breaking (2011/2012).** Solaris project (National Synchrotron Radiation Centre at Jagiellonian University) is entering important and dynamic stage. The name of the center was inspired by the title of world famous novel "Solaris" (published 1961) by Stanisław Lem. The first contracts for the machine hardware have been signed. The iron blocks for the storage ring magnet structures have been casted and are already undergoing thermal treatment before precise machining. The terms of the contract for the injecting linac sections has been agreed upon and will be signed shortly while the RF modulators powering the linac are being produced. The Solaris building design is going to be finalized in September followed by the building permit application. Ground breaking is expected early in 2012.

**Imaging beamline at the DIAMOND source (2012).** A new beamline, I13, devoted to X-ray imaging at Diamond (Didcot, UK) will become operational in 2012. Collection of high-quality 3D images of various objects will be possible.

**New spectroscopy beamline at ESRF (2013).** The beamline, UPBL6, is under construction in ESRF, Grenoble. It will enable studies of electronic excitations using inelastic X-ray scattering (RIXS), X-ray Raman spectroscopy and emission spectroscopy.

**Establishment of the European Synchrotron User Organization (ESUO) (March 2010).** The establishment of the European Synchrotron User Organization (ESUO), an organization representing the interests of European users of synchrotron radiation is described by U. Pietsch and M.J. Cooper, *J. Synchrotr. Radiat.* 17 (2010) 428-429.

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## FUTURE CONFERENCES & WORKSHOPS

**Instrumentation and Methods Development for Synchrotron-based Biomedical Research (DESY Hamburg, October 5 - 7, 2011),**

[http://sni-portal.uni-kiel.de/kfs/Archiv/1st-Announcement\\_Biomedical-Workshop.doc](http://sni-portal.uni-kiel.de/kfs/Archiv/1st-Announcement_Biomedical-Workshop.doc)

**3rd ANKA / KNMF Joint Users Meeting (Karlsruhe, Germany, October 13 - 14, 2011),**  
<http://anka.iss.kit.edu/english/448.php>

**24th MAX-lab Annual User Meeting (Lund, Sweden, November 14-16, 2011),**  
<http://www.maxlab.lu.se/usermeeting/index.html>

**NSRRC users meeting, design discussion of the XPCS/cSAXS beamline at TPS, protein solution SAXS/SANS data analysis tutoring (Hsinchu, Taiwan, October 19 - 21, 2011),** <http://usersmtn.nsrcc.org.tw/eng/>

**New Science Opportunities at FLASH (Hamburg, Germany, October 12 - 14, 2011),**  
<https://indico.desy.de/conferenceDisplay.py?ovw=True&confId=4425>

**6th Asia-Oceania Forum for Synchrotron Radiation Research and 4th SLRI Annual User Meeting** (Bangkok, Thailand, October 24 - 28, 2011),  
<http://www.slri.or.th/aofsrr2011/index.php>

**International Conference on the Use of X-ray and Related Techniques in Arts and Cultural Heritage** (Sharjah/ Dubai, United Arab Emirates, December 7 - 8 2011),  
<http://www.aus.edu/conferences/XTACH11/index.php>

**Analiza Chemiczna w Ochronie Zabytków** (Warszawa 8 - 9 grudnia, 2011), <http://www.chem.uw.edu.pl/archeometria/>

**Improving the data quality and quantity for XAFS experiments (Q2XAFS)** (Photon Factory, KEK, Tsukuba Japan, December 8 - 9, 2011),  
<http://pfwww.kek.jp/Q2XAFS2011/>

**Laue Day and 20th Annual Meeting of DGK (a conference commemorating the discovery of X-ray diffraction)** (Munich, March 12 - 15, 2012), [www.dgk-conference.de](http://www.dgk-conference.de)

**IEEE Symposium on Biomedical Imaging (ISBI 2012)**, (Barcelona, May 2 - 5, 2012),  
<http://www.biomedicalimaging.org/>

**International School of Crystallization (ISC)**, (Granada, May 21 - 25, 2012), <http://www.iscgranada.org/>

**11th International School and Symposium on Synchrotron Radiation in Natural Sciences (ISSRNS 2012)** (Kraków, Poland, May 20 - 25, 2012).  
<http://issrns2012.ifj.edu.pl/>

**International School of Crystallography, 45th Course: Present and Future Methods for Biomolecular**

**Crystallography** (Erice, Italy, May 31 - June 10, 2012),  
<http://www.csem.infn.it>,  
<http://www.crystallalice.org/Erice2012/2012.htm>

**11th International Conference on Synchrotron Radiation Instrumentation** (Lyon, France, July 9 - 13, 2012),  
<http://sri2012.org/>

**Science at FELs** (a satellite meeting to the 11th International Conference on Synchrotron Radiation Instrumentation in Lyon, France) (Hamburg, July 15 - 18, 2012, <http://science-at-fels-2012.desy.de>

**Experimental and Computational Bio-Imaging and Visualization, a symposium within the 15th International Conference on Experimental Mechanics (ICEM15)**, (Porto, Portugal, July 22 - 27, 2012),  
[www.fe.up.pt/clme/icem15/index.htm](http://www.fe.up.pt/clme/icem15/index.htm)

**International Small-Angle Scattering Conference (SAS2012)** (Sydney Australia, November 18 - 23, 2012),  
<http://www.sas2012.com/>

**15th International Summer School on Crystal Growth** (Gdańsk, Poland, August 6 - 10, 2013),  
<http://science24.com/event/isscg15/>

**17th International Conference on Crystal Growth and (jointly) 15th International Conference on Vapor Growth and Epitaxy (ICCG-17 & ICVGE-15)**, (Warsaw, Poland, August 11 - 16, 2013), <http://science24.com/event/iccge17/>

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