Recent Advances at the Singapore Synchrotron Light Source

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The Singapore Synchrotron Light Source (SSLS, <http://ssls.nus.edu.sg>) is a university-level Research Institute at the National University of Singapore (NUS). It is dedicated to generating and exploiting synchrotron radiation for research and development purposes and provides services for customers including research institutions, industry and institutions of public interest.

At present, synchrotron radiation is produced by a compact 700 MeV electron storage ring, dubbed Helios 2, with two 4.5 T superconducting dipoles. The storage ring is injected from a 100 MeV racetrack microtron. The whole accelerator system was built and delivered by Oxford Instruments. The radiation spectrum emitted from the dipoles covers a spectral range of 7 orders of magnitude from hard X-rays to the far infrared.

Five beamlines and experimental stations are in operation comprising a micro/nanomanufacturing facility (LiMiNT), a phase contrast imaging and tomography beamline (PCIT), a soft X-ray facility for surface, interface, and nanostructure science (SINS), a hard X-ray facility for diffraction, absorption spectroscopy and fluorescence (XDD) and an infrared spectro/microscopy facility (ISMI). A further beamline for electron beam diagnostics is under construction. This portfolio of experimental facilities makes SSLS rather attractive for a wide variety of research disciplines including biomedical engineering, catalysis, data storage, environmental science and engineering, life sciences, materials science and engineering, micro/nanotechnology and semiconductor manufacturing.

By now, SSLS has a userbase of more than 300 researchers, 83% coming from Singapore and 17% from abroad. Besides research work, SSLS is also doing commercial work for customers in both fields, micro/nanomanufacturing and the analytical characterization of materials and processes.

The R&D programme of SSLS comprises

- micro/nanomanufacturing focusing on devices, engineered materials, and 10 nm nanolithography, the
- analytical characterization of materials and processes, and
- work towards new synchrotron light sources using superconducting miniundulators.

Recent achievements in these fields will be presented including the

- micro/nanomanufacturing of advanced electromagnetic metamaterials and of nanohole arrays for filtration,
- soft X-ray spectroscopic results concerning charge transfer at the molecule-metal interface of self-assembled BBB and BFF obtained by core-hole clock spectroscopy,
- characterization of lubrication layers on magnetic hard disks as well as of sandwiched layered structures ZnS-SiO_2/$Ge_2Sb_2Te_5$/ZnS-SiO_2 for data storage,
- high-resolution diffractometry of AlGaN/GaN quantum wells grown on triangular rods of sapphire where differences of layers on different slopes of the rods could be detected, and
- grazing incidence XAFS studies to reveal the structure of 20 nm thick Co films used for magnetic recording and storage.

Finally, a conclusion and an outlook to future work will be given.