

New developments for the Australian Synchrotron

Marian Cholewa

Monash Centre for Synchrotron Science (MCSS), Monash University, Australia

Australian Synchrotron (AS) is in the routine operation since 2007. The speaker has been involved in several new projects, such as:

- **Transmission X-ray Microscopy (TXM):** recently we have performed experiments with the highest possible spatial resolution at Advanced Light Source (ALS) in USA and BESSY II in Germany. A 3-dimensional tomography has been performed on a single cell of coccolithophores with resolution down to 20 nm. Coccolithophores are marine unicellular algae, notable for the intricate calcite (CaCO_3) structures (coccoliths) which surround each cell. Though tiny (diameter of ca. $5\mu\text{m}$ for *Emiliana huxleyi*), they can form vast oceanic blooms, representing the largest class of calcifying organisms on the planet and constituting a fundamental part of the global carbon cycle through their carbon assimilation and calcification – the latter represents a major sink of carbon to the ocean floor sediments. Understanding the process of calcification and the formation of coccoliths is of fundamental importance to models of carbon fluxes in the oceans and global climate change.
- **TXM-IRM-CM beamline at the Australian Synchrotron:** this project is closely related with the proposed development of a new beamline at the Australian Synchrotron. This beamline will combine features of (a) Transmission X-ray Microscopy (TXM), (b) Infrared Microscopy (IRM) and (c) Confocal Microscopy (CM) and will create a unique facility for high resolution imaging.
- **Development of a high resolution imaging detector for X-rays:** several imaging groups in Australia, including Centre for Coherent X-ray Science, have been working on development of a high resolution X-ray detector. The speaker has been involved in designing an X-ray Electron Emission Microscopy (XEEM) system. Development of this new detector will be based on development of new exotic materials with superior secondary electron emission. These materials could also be used for development of highly efficient detectors for ions and electrons.
- **Single cell irradiation system.** While in Australia he has been also involved in the development and applications of high resolution live cell irradiation facilities with X-rays which also will be discussed. Experimental data from Photon Factory in Japan and Australian Synchrotron in Melbourne will be presented. This project is closely related to development of a microbeam radiotherapy (MRT) at the AS.