Nanofluidic cell for time resolved X-ray studies at MAXIV using grazing incidence X-ray geometry

Jurgilaitis A.[1], Labecka N.[1], Coudert-Alteirac H.[1], Van-Thai P.[1], Terry A.[1], Larsson J[1,2],

[1]MAX IV Laboratory, Lund University, P.O. Box 118, SE-221 00 Lund, Sweden

[2]Department of Physics, Lund University, P.O. Box 118, SE-221 00 Lund, Sweden

Keywords: Nanofluidics, Time resolved X-ray scattering, Protein analysis.

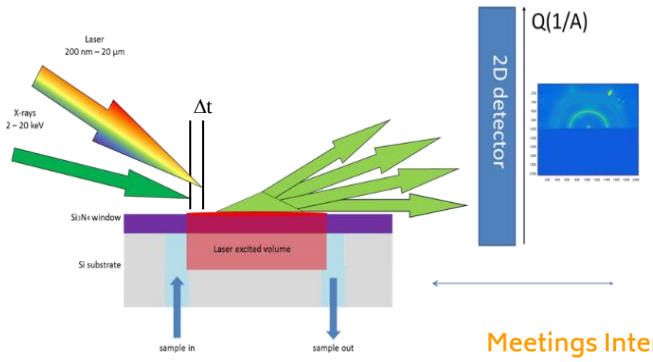
I. Abstract

We have developed a nanofluidic cell dedicated to perform time resolved X-ray studies at the FemtoMAX[1] beamline at MAXIV facility in Sweden. The FemtoMAX beamline is designed for ultrafast X-ray experiments on the femtosecond time scale. X-ray pulses are generated by sending an ultrashort pulse of electrons from the 3 GeV linac through an undulator. The beamline is equipped with a powerful, pulsed laser system that allows to excite samples using 200 nm – 20 um laser light.

The idea behind this nanofluidic cell is that it works as a liquid sample environment. The volume of the cell is less than 0.5 µL .This allows for the sample to be refreshed continuously by pushing it in/out of the interaction region. The sample environment have been developed using two silicon wafers which are bonded together. The bottom part accommodate two ports allowing to send sample in/out while the top part contains a ultrathin Si_3N_4 window, which is 50µm x 10 mm in size and < 50 nm in thickness. The optically transparent Si_3N_4 window is used for laser photoexcitation while delayed X-rays is used as a probe. A laser excited[2] sample can experience structural changes which can be studied using X-ray light as a probe. The scattered X-ray signal is subsequently collected using a 2D detector. The idea is graphically shown in the image below.

We will present recent nanofluidic cell performance with respect to durability. We have also performed optical tests at FemtoMAX. A number of various liquids with ranging viscosities as well as protein sample solutions (Hemoglobin and α-Synuclein fibrils) have been tested. We have discovered that the nanofluidic cell works well with a flow rates up to 5mL/min and 25mJ/cm2 @ 800nm.

II. Image: Representation of a nanofluidic cell for time resolved X-ray scattering experiments.



III. Reference:

1 H. Enquist, A. Jurgilaitis, A. Jarnac, Å.U. J. Bengtsson, M. Burza, F. Curbis, C. Disch, J. C. Ekström, M. Harb, L. Isaksson, M. Kotur, D. Kroon, F. Lindau, E. Mansten, J. Nygaard, A. I. H. Persson, V. T. Pham, M. Rissi, S. Thorin, C.-M. Tu, E. Wallén, Xiaocui Wang, S. Werin and J. Larsson FemtoMAX - an X-ray beamline for structural dynamics at the short-pulse facility of MAX IV, Journal of Synchrotron Radiation 25, 570 (2018).

2. M. Marcellini, A. Nasedkin, B. Zietz, J. Petersson, J. Vincent, F. Palazzetti, E. Malmerberg, Q. Kong, M. Wulff, D. van der Spoel, R. Neutze, and J. Davidsson, the Journal of chemical physics 148, 134307 (2018).

IV. Biography:

Andrius Jurgilaitis has completed his PhD at the age of 29 years from Lund University. Postdoctoral Studies at MAXIV facility working on FemtoMAX project, Sweden.

V. Presenting author details



Full Name: Andrius Jurgilaitis
Contact number: +46 706428715
Session name/ number: Microfluidics
Category: Oral presentation

Copyright © 2019 Meetings International Pte Ltd. All Rights Reserved.