

Optical Tweezers Sample Manipulation for Synchrotron Radiation Experiments

Dan Cojoc
CNR-IOM Trieste, Italy

Using a tightly focused laser beam, optical tweezers (OT) allows sample trapping and manipulation in liquid, without any mechanical contact. The sample size can range from tens of nanometers to tens of microns, with arbitrary shape and material. These properties make OT a flexible and valuable tool to manipulate a wide range of micro-samples, in particular fragile, biological and soft mater objects.

Here, I discuss the properties of the OT for sample manipulation in Synchrotron radiation experiments with micro and nano-beams. I will present the characteristics of the first OT setup developed in collaboration with the groups of Heinz Amenitsch (Technical University of Graz) and Christian Riekkel (ESRF – Grenoble), successfully installed at the ID13 Microfocus Beamline – ESRF. The performance will be discussed presenting experimental results obtained by small-angle and wide-angle X-ray scattering with focused beam on liposomes, starch granules, and insulin micro-crystals. I will discuss also on a recent application of this setup in an elemental imaging approach for the analysis of biological model organisms and single cells in their natural, in vivo state.

Finally I will present further openings offered by OT for multiple sample manipulation and local modification of the chemical environment, and discuss on the possible use of the laser beam radiation pressure for sample manipulation in air and vacuum.