ID10-EH1 end-station: a new instrument combining surface scattering diffractometer and a double crystal deflector for studies on liquid surfaces and interfaces

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The ID10-EH1 end-station at the European Synchrotron Radiation Facility is a new multi-purpose, high-brilliance undulator beamline for high resolution X-ray scattering and surface diffraction on bare and buried LIQUID, soft and solid surfaces and interfaces. The key element of the end-station is a double crystal beam deflector (DCD) which is merged together with the surface diffractometer in a single instrument. This approach allowed increasing the mechanical stability of the heavy weighed DCD assembly. The purpose of the end-station is to perform studies on surfaces and interfaces, in general, and on liquid surfaces and interfaces in a large extend thanks to the DCD which can tilt down the synchrotron X-ray beam on horizontal plane in a large angular range spanning from 0 to 90 degrees. ID10-EH1 end-station is a successor of the former ID10 TROIKA-II beamline exploited a single crystal deflector scheme for liquid surface studies [1]. New instrument is a fusion of more than fifteen years experience with the DCD concept [2]. ID10-EH1 DCD scheme is built on the base of the symmetric Bragg Ge(111) and Ge(220) reflections. DCD deflector provide the X-ray beam in the energy range from 7 keV to 30 keV with almost equal monochromatic beam intensity, about 10^{12} photons/sec, and the maximum value of the scattering vector Qz=24 nm^{-1} at any of these energies and keeping the beam size on sample as 10 microns by 250 microns, vertically and horizontally respectively. Main scattering techniques of the end-station are X-ray Reflectivity, Grazing Incidence Diffraction, Grazing Incidence Small-Angle X-ray Scattering and X-ray Fluorescence. Thanks to a polyvalent detector arm, capable to hold simultaneously up to three detection schemes, all these techniques can be applied on the same sample and at the same experiment. Moreover, in some combinations these techniques can be used simultaneously. One of the important issues of the ID10 DCD is a way of its alignment, which will be presented in this work. Versatility of the new instrument will be demonstrated by selected examples of scientific studies on soft and liquid interfaces.

References

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