Design and Properties of the IR-Beamline at Bessy II

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This year a large acceptance angle (40x60 mrad\textsuperscript{2}) infrared beamline will be put into operation at BESSY II. This highly brilliant infrared source will be used for spectroscopic investigations of biological systems, for microscopy of same and for investigations on the structural and functional interactions of proteins. Vibrational, structural and electronic properties of surfaces and thin layers will be studied using infrared ellipsometry. The experimental station consists of a Fourier transform infrared (FTIR) vacuum spectrometer (Bruker 66/v), an infrared microscope (Thermo Nicolet Continuum and Nexus\textsuperscript{TM}) and an infrared ellipsometer. In a later stage of the project an ultra high vacuum chamber will be installed for surface science experiments.

After theoretical and experimental investigations on the infrared synchrotron source and under the specific constraints of BESSY II [1] it was shown that the beamline would not benefit from using the so-called infrared edge radiation. Therefore, the beamline utilizes the radiation emitted from the homogenous field of a bending magnet. The radiation is extracted upwards out of the storage ring plane and is then focused by a pair of cylindrical mirrors for transmission through a CVD wedged diamond window outside of the radiation shield wall, separating the ultra high vacuum system from the subsequent high vacuum system. In order to avoid heat load problems, the plane extracting mirror is split into two halves, which allows the high energy fan of the synchrotron radiation to pass through to an absorber. After the window, a second pair of cylindrical mirrors refocuses the deep, curved and diverging source to a more symmetrical end focus. Plane and parabolic mirrors are used to optimally couple alternatively one of the two spectrometers to the beamline. The optical design was optimized by means of ray traces [2].

In spring this year, during the shut down period of BESSY II, all parts of the beamline inside the radiation shielding tunnel including the modified dipole chamber will be installed. The installation of the remainder of the beamline as well as the experimental stations will follow during normal operation of the storage ring. In this paper the mechanical and optical design of the beamline and the experimental stations will be presented. First experimental results on the performance of the beamline will be discussed and compared with numerical calculations.

References


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