Photo Reflectivity and Photo Electron Yield of Technical Materials for High Energy Accelerators

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In High Energy Colliders and, more generally, in particles accelerators, the circulating charged particles produce Synchrotron Light Radiation (SR). In all cases, the SR impinges against the wall of the vacuum chambers with a characteristic energy distribution and with a very small incidence angle. The interaction between SR and the wall surface can induce heat loads, molecular desorption and photoelectron production. All those phenomena are dependent on the SR energy spectrum, the geometrical conditions and the properties of the wall chambers' material. They may cause beam and vacuum instability, with subsequent limitations of machine performance and increase of operational cost. Hence, the choice of materials to be used and their final surface treatment is one of the important step of the design phase. Numerical simulation, used to support those choices, base their validity also on the reliability of all input parameters in use. Therefore, the accurate measure of the relevant physical properties of materials in use, including their behavior after SR irradiation, becomes a prerequisite to allow accurate predictions.

In this work, we present some of the results of an extensive experimental campaign launched to measure SR related properties on real accelerator materials. We measured Photo Reflectivity (R), its geometrical distribution and the electron produced per incident photon (Photo Electron Yield - PY). The experiments were carried out at the OPTICS beamline of BESSY-II using a state of the art "at wavelength" reflectometry station. This experimental set-up allowed to study candidate materials for High-Luminosity-LHC and Future Circular Collider (FCC-hh) in experimental conditions close to the operational ones.