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The KEK photon beamline for desorption studies: preliminary results and plans for future studies in the FCC hh context

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Abstract title

In the framework of the CERN-KEK collaborations, experimental studies on vacuum chamber properties under Synchrotron Radiation (SR) environment started in 2014. The goal is to characterize the effectiveness of thin-film coatings against photon-stimulated desorption (PSD) and photoelectron (PE) yields. The study outcome will be applied to vacuum system designs for future accelerators, such as SR light sources and the FCC-hh, where PSD and/or PE issues could limit the accelerator performance.

Sample vacuum chambers are manufactured and coated at CERN, and then installed in an SR experimental hutch in KEK's Photon Factory (PF). The critical energy of the SR used in this experiment is 4.0 keV, which is similar to those of the FCC-hh designs, i.e., 4.3 keV from 16-T dipoles and 5.4 keV from 20-T dipoles. The SR power density on the sample surface at 10-mrad incidence is 20 W/m, and is also similar to those of the FCC-hh designs, which ranges 28–44 W/m per aperture.

In 2014, PSD and PE properties of six samples, including TiZrV Non-Evaporable Getter (NEG) and amorphous carbon coatings, were measured at room temperature. The effects of NEG coating activation (250℃ for 4 hours) and vacuum firing (950℃ for 2 hours) of the bulk stainless steel were also evaluated. The PSD and PE yields as a function of the photon dose were obtained, showing the lowest PSD yield with the activated NEG coating and the lowest PE yields with the carbon coating. The detailed results will be presented, including the behaviors of interesting gas species and the effect of the external magnetic fields on the PE currents.

Further studies on the effect of NEG surface conditions are planned for 2015, as well as the measurements at 77 K (LN2) to simulate the FCC-hh beam screen (40-60 K).

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