Material properties of impact to accelerator's performances in cryogenic vacuum

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In the complex operation of accelerators, material properties of their vacuum components represent a crucial aspect to assure their best performances. Such properties are not only intrinsic to each surface but are also related to the many interactions such surfaces will undergo during machine operation. Among them, photons and/or electrons impinging on the accelerator's wall can indeed give rise to various detrimental effects. Not only photon- and electron-desorption processes will take place but also so called “electron cloud effects” (ECE) could be initiated. ECE is known to be capable to perturb the stability of the beam and, therefore, the overall machine performances. One of the main parameters influencing ECE in accelerators is the capability of their vacuum components to produce secondary electrons when an electron impacts the wall. Secondary Emission Yield (SEY) is defined as the ratio of the number of electrons leaving the sample surface to the number of incident electrons. Such parameter is specific of each material and have a remarkable sensitivity to its surface characteristics.

When the vacuum components are at cryogenic temperature, the complexity of such studies is certainly enhanced by the possible presence of different layers of residual gas molecules that may be adsorbed on the walls. Not only such adsorbates will modify relevant material properties *per se*, but also because they are interacting with photons and electrons.

In this general framework, cryogenic vacuum surfaces of proposed materials to be used, in the LHC high luminosity upgrade and in FCC-hh must be studied with great details at operating temperature and in presence of adsorbates. At LNF, a significant effort has been produced to specifically optimize experimental *apparata* to study electron and/or photon interaction with cold surfaces. Some relevant results of this research line will be presented in this talk.

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