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Advances in Low SEY Engineered Surface for Electron Cloud Eradication

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Developing a surface with low Secondary Electron Yield (SEY) is one of the principal methods of mitigating the beam-induced electron multipacting and electron cloud in high-energy charged particle accelerators [1]. Since the wall material, surface chemistry, topography and electron energy are the parameters that influence the SEY, common mitigation mechanisms are based on engineering the above parameters. Recently ASTeC has demonstrated that nano- and microstructures engineered on Cu, Al and Stainless steel surface reduces SEY to less than 1 [2]. Further development led to laser engineered surfaces with SEY<0.8 on as-received surfaces of aluminium, stainless steel and copper. Furthermore these surfaces are compatible with accelerators beampipe requirements, providing low surface resistance, low outgassing, low photon and electron stimulated desorption. Such structures can be readily produced by nano- and sub-nanosecond pulsed laser. SEY can be further reduced to an even lower value by bake-out and/or photon and/or electron bombardment. A systematic analysis of surface composition and chemistry (using XPS), the surface topography (using SEM), and SEY measurements with primary electron energies ranging from 50 to 1000 eV is reported and correlated to the laser treatment conditions. A test liner was prepared by ASTeC for a first machine test of such new anti-e-cloud technique. The liner has been installed at SPS for testing in the LHC-like beam conditions.

[1] M.T.F. Pivi, L. Wang, T. Demma, et al. Recommendation for the feasibility of more compact LC damping rings. Proc. of IPAC'10, Kyoto, Japan, 23-28 May 2010, pp. 3578-3580.

[2] R. Valizadeh, O.B. Malyshev, S. Wang, et al. Low secondary electron yield engineered surface for electron cloud mitigation. Appl. Phys. Lett. 105, 231605 (2014).

Primary author: Dr VALIZADEH, Reza (STFC)

Co-authors: MALYSHEV, Oleg (ASTeC, Daresbury Laboratory); Mr SEAN, Taaj (STFC and Manchester University)

Presenter: Dr VALIZADEH, Reza (STFC)

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