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Thin films for the mitigation of electron multipacting

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For vacuum scientists and the accelerator community, it is of paramount importance to find solutions for high energy machines to mitigate : (i) pressure increases induced by the desorption of electrons, photons and ions; (ii) clouds of ions or electrons inducing beam instabilities, heat deposits on the vacuum chamber walls or stimulated molecular desorption; (iii) multipactor effect in superconducting rf cavities. The solutions call for specific surface treatments, including the use of deposits of thin films whose nature and morphology should lead to the improvement of the surface properties, in particular to reduce the secondary electron emission yield (SEY). We present a comparative study of several thin layers (CuO, TiNC, TiN, TiVZr, Zr, amorphous-C) whose SEY as well as the surface chemistry were characterized before and after conditioning by electrons. We focused in particular on the conditioning rate as a function of the nature of the thin film. This investigation highlights the influence of thickness and roughness of thin layers on the surface properties for accelerator applications.

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