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Effect of molybdenum coatings on the accelerating cavity quality factor: a numerical study

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Methods for realizing resonant cavities with high field gradients have been studied in the last years. Cavities are often made of copper, which however has too low work function (WF) (thus eventually leading to dark currents) and tends to produce uncontrolled discharges (breakdowns) which might damage the copper surface, finally degrading the cavity performance. For this reason, the idea of lining the copper cavity with a layer of molybdenum/molybdenum oxides, characterized by a higher WF and greater resistance to stress than copper, has been being pursued for some years.

In this paper, we analyze the effect of the molybdenum coating on the cavity quality factor. To do this, an electromagnetic simulation is performed to evaluate the effect of a coating on the effective surface impedance of the cavity surfaces as a function of the thickness and resistivity of the coating. Since the quality factor is related to the impedance of the walls, the estimate of the impedance provides useful information on the possible variation of the cavity quality factor.

Primary authors: Dr MARCELLI, Augusto (INFN); Dr SPATARO, Bruno (INFN); Dr GIULIANO, Lucia (Sapieza University, INFN); Dr CARILLO, Martina (Sapienza University; INFN); Prof. POMPEO, Nicola (Roma Tre University; INFN); Dr VIDAL GARCIA, Pablo (Roma Tre University); Prof. SARTI, Stefano (Sapienza University)

Presenter: Dr VIDAL GARCIA, Pablo (Roma Tre University)

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