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RF copper based devices with oxide coatings

One of the most demanding development of the accelerating technologies is the manufacture of reliable RF devices suitable to withstand the highest accelerating gradients required by the design and the construction of the future accelerators [1]. Actually, RF cavities working at gradients of 100 MV/m or higher could be successfully used for the next generation of linear accelerators planned for research applications, but even to design compact and less expensive industrial accelerators, e.g., those that could be used in medicine or in the food industry.
Starting from well-established RF technologies based on copper devices, we are trying to improve performances of OFHC copper cavities, coating their internal surfaces with transition metals oxides, such as MoO3 [2]. This coating may allow to optimize the properties any RF device reducing field emission, breakdown rate, and thermal damage in the presence of high electric fields [3].
In order to characterize the properties of such coated devices and to test the damage induced by high electric fields on a RF cavity with a coated internal surface we developed the technology to coat and assemble a cylindrical cavity and a reliable protocol to irradiate metallic coated surfaces with a high intensity coherent THz beam generating an electrical gradient up to few GV/m. Then we assembled a real copper-coated RF cavity with a cylindrical shape made by 4 cylindrically shaped sections each one diamond milled to have internal walls with a roughness <10 nm and coated with a MoO3. layer about 100 nm tick.

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