

# X-ray characterization of thin conducting MoO<sub>3</sub> films on copper. A new opportunity for technological applications

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The next generation of accelerators has to use cavities with higher RF fields in order to significantly reduce the length and the cost of particle accelerators and to make available these devices to a larger number of users. [1] In order to accomplish this goal is extremely important to minimize overheating effects due to the RF field and reduces the breakdown phenomena. The latter are highly destructive and induce permanent damages on the surface of any copper RF device. [1,2] The use of materials with improved thermo-mechanical properties or working at cryogenic temperature are possible alternatives. [3] Here we will present an alternative approach, which consists in the deposition of thin films on the inner copper surface of RF devices. We developed and built a dedicated evaporation setup to growth by vacuum sublimation molybdenum trioxide films on copper and we measured both the conductivity and the work function. [4]

We will present the x-ray characterization of thin molybdenum trioxide films deposited on thick metallic copper substrates manufactured with a low roughness. Actually, a thin layer of molybdenum trioxide, a hard transparent insulator deposited on copper tends to be conductive, while its work function remains almost constant and higher than the original copper surface. [4]

By using X-ray Diffraction and X-ray absorption spectroscopy, we characterized the structural order and the electronic properties of these films. In particular the XANES spectroscopy probed the presence of insulating or metallic oxide phases and correlate the electronic properties with the conductivity properties of these coatings. Indeed these films are complex nanophase systems where molybdenum may exist in several oxidation states: Mo<sup>4+</sup>, Mo<sup>5+</sup> and Mo<sup>6+</sup> and whose properties can be tuned by changing the substrate and/or the treatment after the evaporation for different technological applications. The measure of a the edge shift at the Mo K-edge can be also correlated with the Fermi level, a parameter that is associated to the transport properties of these films. [4]

## References:

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