Experimental studies of electron emission properties under magnetic field for copper samples: effect of the surface morphology.

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Magnetic confinement fusion devices [1], particle accelerators [2] and space communication payload [3], among other applications, are concerned by multipactor effect. This undesirable phenomenon is a resonant process which can lead to power handling limitation of RF components [4]. To determine the multipactor power threshold, experimental tests or/and simulations are commonly used. The power threshold is closely related to the electron emission properties of the RF component materials. Accurate power threshold predictions by simulations should be based on the use of accurate electron emission propriety data [5]. In some situations [1]–[3], the RF components are submitted to DC magnetic fields which might affect the electron emission properties and hence the multipactor power threshold.

In a collaborative effort between French research centres CEA, CNES and ONERA, a new experimental setup specially designed to investigate the effect of DC magnetic field on the electron emission properties was developed. In this paper, we first describe the development of the experimental setup and the optimisation of the associated measurement methodology. Then we show and analyse the total electron emission yield (TEEY) measurements made on copper samples under magnetic field perpendicular to the sample surface. We have studied various surface morphologies such as laminated and polished and have observed TEEY increase as well as decrease depending on the magnetic field amplitude and the surface morphology. With incident electron at first cross-over energy (E_{C1}), DC magnetic field has a greater influence on the laminate surface than the polished one (respectively TEEY decreased to 45% and 5%). Such impact of the magnetic field must be considered on multipactor effect simulations codes.

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