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Beyond bulk Nb

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With the development of energetic vacuum deposition techniques, high quality Nb films have been produced supporting the promise of high RF performance. A Nb/Cu thin film deposited by ECR (electron cyclotron resonance) plasma has shown a significantly improved Q-slope, at 4 K and 400 MHz, compared to magnetron sputtered Nb films. Another category of ECR Nb films show first flux penetration at 180 mT, close to bulk Nb Hc1. In energetic condensation, the controlled incoming ion energy enables a number of processes such as desorption of adsorbed species, enhanced mobility of surface atoms and sub-implantation of impinging ions, thus producing improved film structures at lower process temperatures. All these processes along with the quality of the underlying substrate have an important influence on the nucleation and subsequent growth of the Nb film, creating a favorable template for growing the final surface exposed to SRF fields. Each phase in the film growth can be tailored in order to optimize the final RF response of the Nb film. This contribution shows how the ion energy and thermal energy provided to the substrate influence the nucleation, structure and defect density, and quality of the final RF surface for ECR Nb films.

Primary author: VALENTE-FELICIANO, Anne-Marie (Jefferson Lab)

Presenter: VALENTE-FELICIANO, Anne-Marie (Jefferson Lab)

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