Contribution ID: **11** Type: **Oral**

Material Physics Studies for High Gradient Cavities at UCLA CYBORG Beamline

Wednesday, 18 October 2023 16:10 (20 minutes)

High gradient RF cavities, especially those at frequencies above S-band, are critical in several concepts for future electron linacs such as the ultra-compact X-ray free electron laser (UCXFEL) and the Cool Copper Collider (C^3). These two designs in particular rely on the cryogenic operation of RF cavities, taking advantage of several complementary physical effects. It is then advantageous to develop in greater detail an understanding of the complex surface and material physics associated with high gradient RF fields in normal conducting cavities. We present here measurements made at the CYBORG (CrYogenic Brightness-Optimized Radiofrequency Gun) beamline at UCLA. In this first phase of study we will relate our temperature dependence measurements of dark current and other RF cavity figures of merit to the general material science research goals via a modified theory of anomalous skin effect regime. The theory will also be presented with additional results from low level RF cavity testing. Future directions will be presented including the status of the second phase of the beamline in which photoemission of novel cathodes in extreme conditions will be studied.

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Session Classification: Afternoon session