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Exploring high gradient limit with cryogenic experiments at FREIA laboratory

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Field emission (FE) and vacuum arcs limit the maximum achievable accelerating field of both normal and superconducting cavities. The performance of accelerating cavities can be improved after a long conditioning process. Understanding this process and the formation of vacuum arcs is important for all technologies where vacuum arcs cause device failure. The understanding could be more complete with novel diagnostic tools and tests in variable environments.

The cryogenic HV system in FREIA laboratory is used to study different aspects of conditioning using DC pulses at a wide range of temperatures, down to 4K. We are currently measuring FE currents during conditioning for Cu, Nb and Ti electrodes in function of temperature and breakdown rate. We are also developing a new characterization method, evaluating the surface resistivity of the electrodes during conditioning. Changes in the surface resistivity could indicate the formation of dislocations below the surface, which has been speculated to be a very important process behind conditioning.

We will present the results of conditioning with the FE measurements and the surface resistivity measurements.

Footnotes

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Paper preparation format

LaTeX

Region represented

Europe

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