Large Electrode System and Breakdown Investigation

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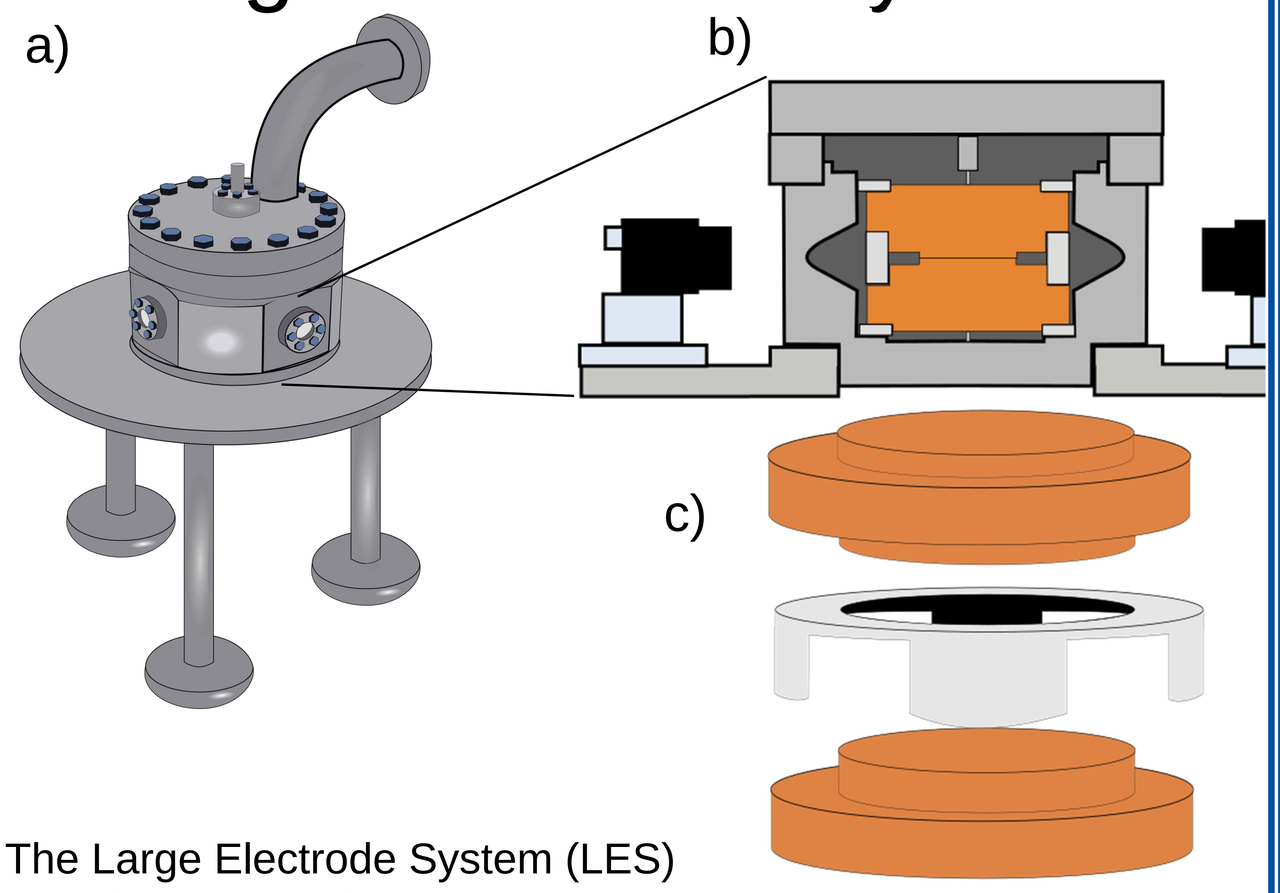
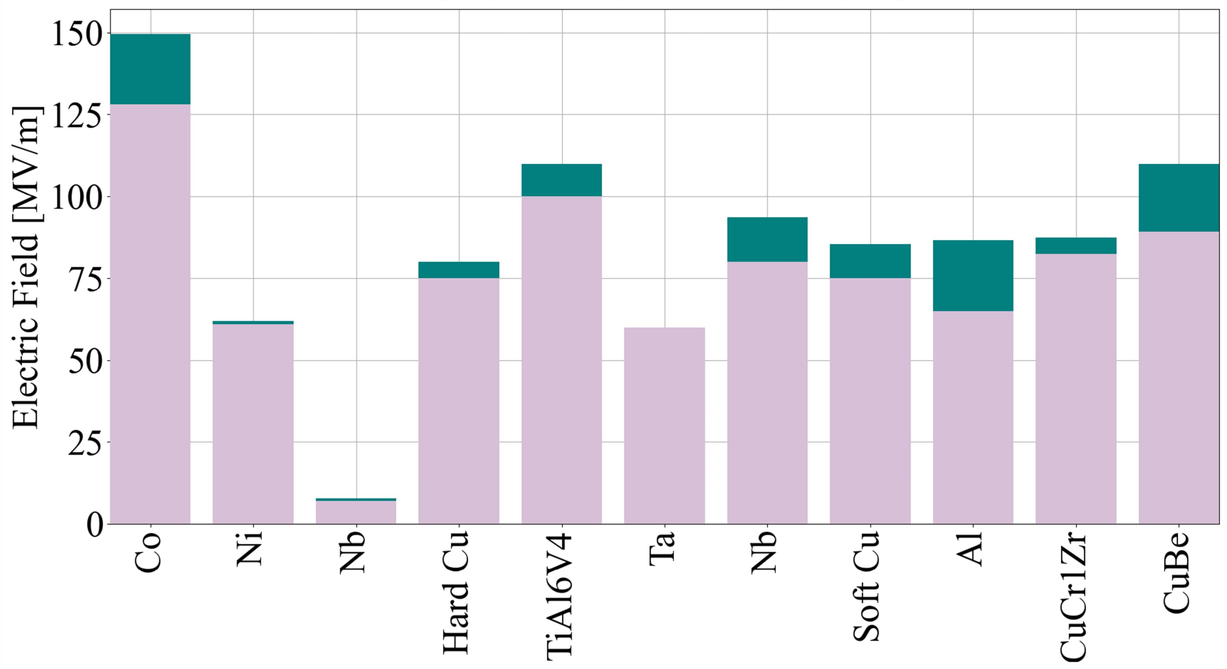
Large Electrode System

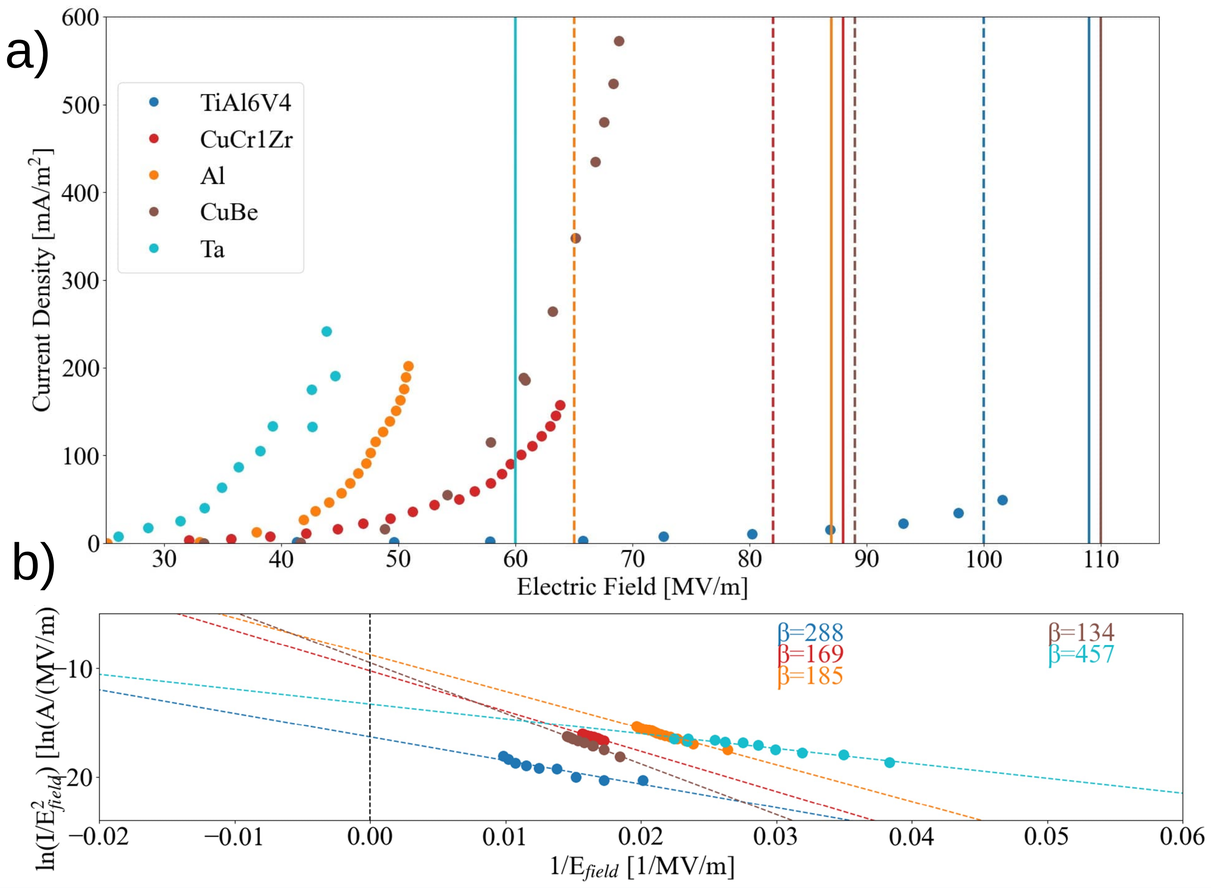


The Large Electrode System (LES) Fig. a) consists of a vacuum chamber with 4 window openings and two HV feedtroughs. Inside are one anode and one cathode, Fig. b). They are seperated using insulated spacers, to give gaps of 20-100 μm, Fig. c).

Conditioning and Maximum Electric Fields



During conditioning, a material is exposed to gradually higher electric fields with a controlled breakdown rate. Many metals and alloys have undergone HV testing at CERN, as shown above. The maximum and final electric fields are presented in green and pink, respectively.



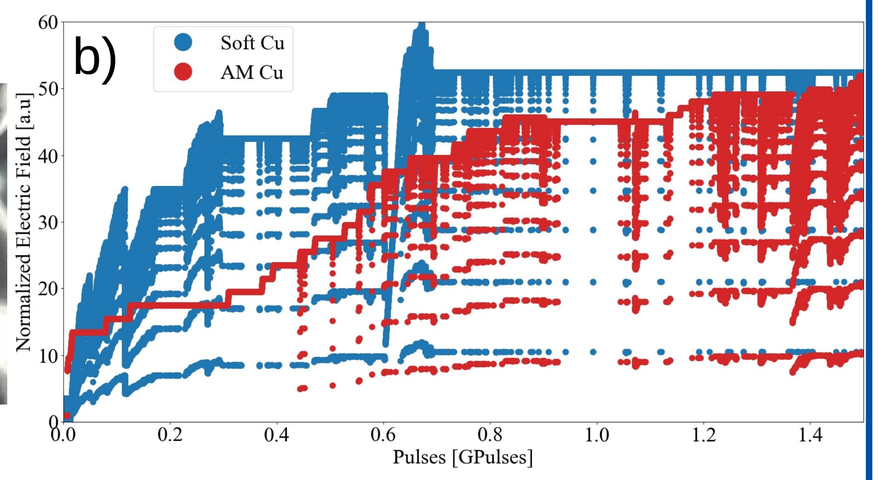
Field Emission

Field emission is a result of exposure to high electrical fields. Field emission can be measured in the LES when applying a constant voltage to the system. Following the Fowler Nordheim equation, a linear relation between $\ln(I/E_{field}^2)$ and $1/E_{field}$ can be found to determine the field enhancement of the surface. Fig. a) shows the current density versus electric field for a list of materials while Fig. b) shows the corresponding field enhancmenets.

The colored lines indicate the highest reached electric fields while the dotted lines represent the final electric fields.

Additional information, such as light emission have also been measured for a list of materials.

Additive Manufactured Electrodes

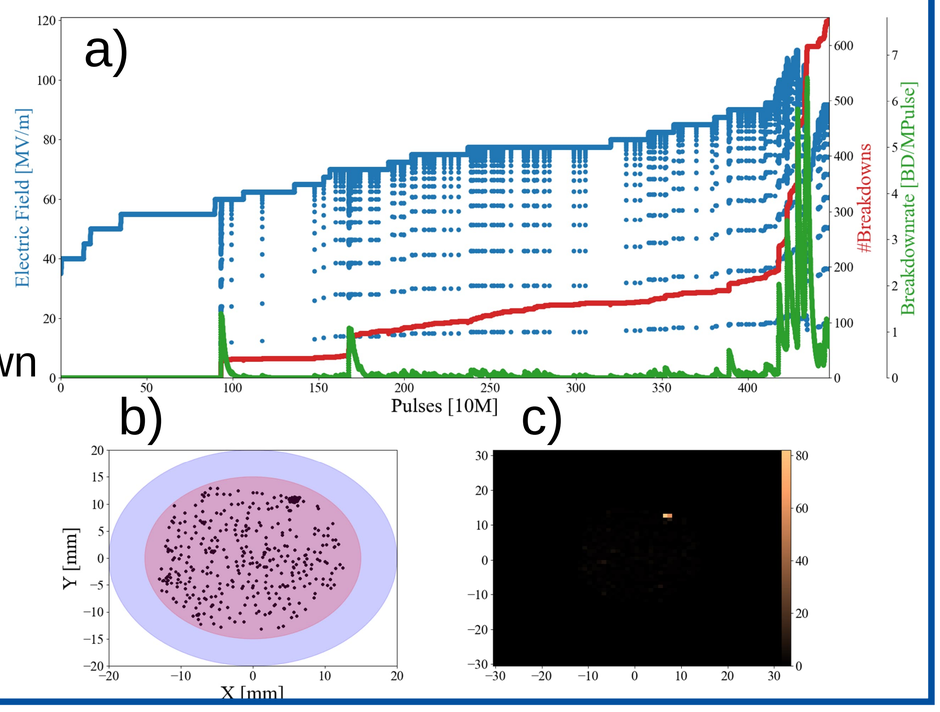


Additively manufactured (AM) electrodes have been tested at CERN where the top surface remains as fabricated, see Fig. a). The AM electrode was tested having 275 and 115 μm gaps. Due to gap dependencies on the final electric field, the data has been normalized and compared with Soft Cu, which had a similar conditioning pulse time. It is observed that both electrodes reach a similar final electric field.

CuBe Electrodes

Initial testing of CuBe indicate it to hold high electric fields (110MV/m) with a low breakdown rate. The electrode experienced a breakdown cluster, which limited its maximum and final electric field.

Fig. a) shows the conditioning, b) shows the breakdown locations and c) shows the breakdown density over the surface.



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