Contribution ID: **35** Type: **Oral**

Investigating Field Emission and Vacuum Breakdown in a 300 kV Bushing Using Fast Frame Imaging, LIBS, and SEM

Tuesday 3 June 2025 09:00 (30 minutes)

Avalanche Energy's Orbitron, a next-generation compact fusion device, requires the reliable transmission of hundreds of kilovolts of direct current (kVDC) into a vacuum maintained at pressures below 10^{-8} Torr. To address this, a novel compact feedthrough is under development and successfully transmits voltages exceeding 300 kV. A major challenge in this effort is mitigating vacuum breakdown and surface flashover across the bushing's insulator. In order to achieve these high voltages, high-voltage conditioning experiments are conducted to eliminate field emission sites where these breakdown mechanisms often originate. This process can result in transient discharges, which can be destructive when they are of high frequency and intensity. This prompts further investigation into their underlying mechanisms. As such, experiments are carried out in which in situ high-speed imaging captures these events in real time, while post-experimental analysis utilizes surface profilometry, laser-induced breakdown spectroscopy (LIBS), and scanning electron microscopy (SEM). These studies suggest that vacuum breakdown and surface flashover mechanisms are both influenced by contamination-induced field emitter formation and subsequent ablation on the cathode. Understanding these mechanisms is essential for improving the reliability of high-voltage bushings in fusion applications and represents a critical step toward a stable fusion plasma in the Orbitron.

Please choose topic that matches most closely your research

Field emission

Author: VORENKAMP, Madeline (Avalanche Energy)

Co-authors: BORGHEI, Moein (Avalanche Energy); Dr TSURKAN, Sergey (Avalanche Energy); Dr LANGTRY, Robin (Avalanche Energy)

Presenter: VORENKAMP, Madeline (Avalanche Energy)

Session Classification: Field emission