

GROWTH OF ELECTRIC FIELD ENHANCING PRECURSORS FOR VACUUM HIGH-VOLTAGE BREAKDOWN

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ABSTRACT

Sudden formation of plasma in a vacuum gap and subsequent high-voltage discharges between electrodes often limits the reliability of high-voltage vacuum electronic device [1]. Electronic field emission (FE) from the negatively charged electrode is assumed a precursor for a subsequent explosive electron emission (EEE) discharge of the macroscopic gap [2]. The reason for the sudden development of discharge events after long periods of reliable operation is still matter of debate. This paper discusses if a relatively slow growth process of carbon and metal-based field enhancing structures may eventually cause avalanche effects of vacuum breakdown and EEE to occur. It aims to explain why the undesired events often happen quasi stochastically after long time of stability, despite of prior conditioning of the high voltage gap [3].

However, using high-resolution SEM / EDX inspection of cathodes, the model could not be verified for the existing conditions inside two types of medical X-ray tubes. It may guide to explain such processes under other conditions.

References

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