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Effects of anode and cathode surface treatments on vacuum breakdown between metal electrodes with 50-ns high voltage pulses*

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Well diagnosed measurements of electrical breakdown between metal electrodes in vacuum have been made using a 1-MV, 50-ns pulse-generator-based test stand [1]. Results with bare, as-machined electrodes showed that cathode surface finish and material have little to no effect on the breakdown electric field. However, changing the AK gap did affect the breakdown field level, suggesting that the anode is involved in cathode turn on. Further tests showed that applying a carbon coating to the anode can dramatically decrease the breakdown field [2]. Here, we report on other anode and cathode surface treatments and how they can enhance or suppress breakdown. Polishing of the anode can prevent breakdown at certain field strengths and decrease the breakdown current at higher fields. Marring a small spot on a polished anode is shown to initiate cathode turn on at a location opposite that spot. The effects of other surface treatments such as metallic and dielectric coatings on anode and cathode surfaces will also be discussed.

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