Test Setup and first Magnetic Measurements of the Arc Ignition Process in a Model Vacuum Switch

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ABSTRACT

Vacuum interrupters (VIs) are essential circuit breakers for energy transmission systems. Their application is widespread in medium-voltage grids as they have a critical role in ensuring the reliability and safety of these power distribution networks [1]. Their primary objective in these networks is to conduct currents during operation and facilitate their interruption. With the increasing share of renewable energies and the consistent transition to greater electrification the demand for efficient VIs will only increase. Thus, increasing the interruption capability of VIs and understanding the physical phenomena is important. The interruption capability of VIs strongly depends on the contact geometry used within the vacuum tube [2]. Special contact geometries force the metal vapor plasma into either a diffuse or a columnar arc mode. Depending on where on the contacts surface the last metal bridge ruptures and the arc forms, the transition of the metal vapor arc to one of these modes can be delayed and, thus, reduce the interruption capability of the VI [2]. This causes a measurable change in the magnetic field surrounding the VI. Therefore, it is essential to investigate the correlation between contact geometries, magnetic fields, and ignition processes. This work presents an experimental setup as well as first measurements to detect the initial location of the metal vapor arc. For this, a magnetic measuring system is used in combination with a model vacuum switch built in [3] with viewing ports. The viewing ports enable a high-speed camera to detect the location of the ignition process and cross-validate the results of the magnetic measurements.

References

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