STUDY OF COSTRICTION PHENOMENA IN HIGH CURRENT VACUUM ARCS

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ABSTRACT

High current vacuum arcs are the working medium in various switching devices in power grids. Those devices have to provide a high number of operations under standard load conditions and safe short-circuit current interruption. The lifetime of contact systems in vacuum switching devices is mainly controlled by limited thermal load of the electrode surface. When the arc remains in diffuse mode, the thermal load is moderate. However, the arc column always tends to constrict when a certain current level is reached. Detailed characterisation of arc constriction process is, therefore, very important both for basic research, like e.g. understanding of arc constriction mechanism and for applications, like e.g. optimisation of vacuum switching devices.
Detailed investigations have been performed for dynamics, spatial structure and charge state distribution in plasma column of high current vacuum arcs during its constriction. Applied diagnostics comprised the measurements of arc current and voltage as well as detailed characterisation of the arc plasma properties and electrode surface temperature by optical methods. The constriction dynamics was observed by a high-speed camera. A recently developed method – intensified video spectroscopy - was applied for determination of plasma temperature and spatio-temporal evolutions of species densities. Near infrared radiation (NIR) spectroscopy have been used for determination of the electrode surface temperature after current interruption. During the active phase, a high-speed camera equipped by a narrow band filter was applied for acquisition of qualitative distribution of the anode surface temperature.
The contribution presents exemplarily results, which illustrate the arc constriction dynamics and related phenomena on microsecond scale.

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Topic: Vacuum Interrupters and Spark Gaps
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