

Study of the Movement and the light Emission of the Plasma Arc in a Contactor

M. Al-Amayreh¹, S. Ausmeier¹, A. Delgado¹, H. Iglseider², C. Weindl³, H. Hofmann³, O. Nilsson⁴, R. Kralik⁴

1 Lehrstuhl für Strömungsmechanik, Friedrich-Alexander-Universität Erlangen-Nürnberg, 91058 Erlangen, Germany. malik.amayreh@lstm.uni-erlangen.de

2 STMS - Consulting, 31552 Rodenberg, Germany

3 Lehrstuhl für Elektrische Energieversorgung, Friedrich-Alexander-Universität Erlangen-Nürnberg, 91058 Erlangen, Germany

4 Schaltbau GmbH, 81829 München, Germany

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Abstract:

This study contributes to the understanding of the plasma arc behaviour in a novel contactor. The influence of the external magnetic field on the motion of the electrical arc has been investigated. The external magnetic field is generated from two coils and two permanent magnets. The contactor is designed that the arc generates the magnetic field in the coils. Thereby, the velocity of the arc plasma increases and accelerates the extinction of the arc.

A system of 32 optical fibres connected to photo diodes (sample rate 50 kHz) and a high speed camera (10,000 frames / s) are simultaneously used to observe the generation, intensity and velocity of the arcs. The light emission of the arc plasma near to the anode and the cathode, the curvature of the arc plasma at different initial AC and DC currents has been investigated. Measurement interval is about 30 ms. It turns out that the extinction of the arc can be accelerated if it is possible to allocate more energy into the coils.

A 3D modelling in the air has been developed in order to study the interaction between the magnetic field and the plasma field. Characteristic measurement for the arc voltage and the coil currents were selected from the DC tests. Fit curves are created and serve as boundary conditions for the numerical simulations. The numerical calculations are in good agreement with the experimental measurements.

References:

- M. Al-Amayreh, S. Ausmeier, A. Petchenko, A. Delgado, H. Iglseider, C. Weindl, H. Hofmann, O. Nilsson, R. Kralik, A. Ignatov (2009). Fachtagung "Lasermethoden in der Strömungsmesstechnik" (GALA), pages 43,1-12
- B. Swierczynski, J. J. Gonzalez, P. Teulet, P. Freton, A. Gleizes (2004). J phys. D: Appl. Phys 37, pages 595 – 609

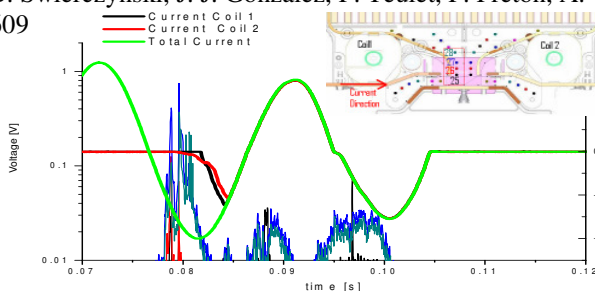


Fig. 1: Light emission in volt at initial current 400A (AC)

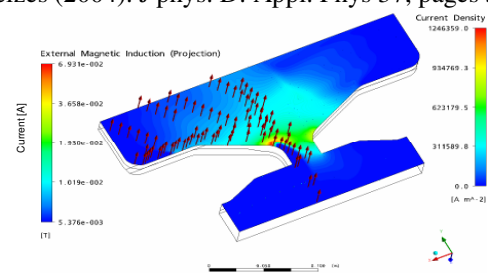


Fig. 2: Simulation of the arc plasma