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Comparative Study on Extinction Process of Gas-Blasted Air and CO2 Arc Discharge Using Two-Dimensional Electron Density Imaging Sensor YUKI INADA, TOMOKI KAMIYA, SHIGEYASU MATSUOKA, AKIKO KUMADA, HISATOSHI IKEDA, KUNIHIKO HIDAKA, The University of Tokyo, TOMOYUKI NAKANO, KOSUKE MURAI, YASUNORI TANAKA, Kanazawa University, TAKESHI SHINKAI, Toshiba Corporation — Systematic comparison of the electron density images for various kinds of arc-quenching gas media inside high-voltage circuit breakers is a promising method for the effective search and development of SF6-alternative gases. However, electron density imaging over the decaying arcs around the nozzle throat of the circuit breakers is extremely difficult by using the conventional arc generation setup and localized type sensing systems, due to the nozzle opaqueness and spatiotemporal instability of long-gap arc discharges around current zero. Here, we achieved two-dimensional electron density imaging over the decaying arcs around the nozzle throat first in the world, by a combination of the development of a unique gas flow nozzle integrating a cubic quartz cell and the single-shot recordings using Shack-Hartmann sensors. Shack-Hartmann sensors were applied to gas-blasted air and CO2 arc discharges under current-zero phases after sudden switch-off of stationary arc currents. These experimental results showed that the electron densities and arc diameters took the minimums in the upper stream nozzle regions with the maximum blasting gas speeds. In addition, CO2 had a shorter electron density decaying time constant than air, which is consistent with the previous theoretical studies on higher interruption performance of CO2 compared with air.

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