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Effect of electrodes photoemission on breakdown voltage of Townsend plasma discharges in helium and argon, gaseous and supercritical DEANNA A. LACOSTE, EM2C Laboratory CNRS / Ecole Centrale Paris, HITOSHI MUNEOKA, The University of Tokyo, THIBAULT F. GUIBERTI, EM2C Laboratory CNRS / Ecole Centrale Paris, KEIICHIRO URABE, SVEN STAUSS, KAZUO TERASHIMA, The University of Tokyo — We report on the effect of light irradiation of tungsten electrode surface on the breakdown voltage in helium and argon for densities up to 23mol/L. The electric discharges were generated in a pin-to-plane electrode geometry, separated by a gap distance of 5μm, the pin electrode being the cathode. The applied voltage was generated by a DC power supply with a current limitation of a few tens of nano-amperes. Two light sources with wavelengths of 365 and 635 nm respectively, were used to irradiate the electrodes and the plasma zone and we studied the influence of the pressure, the temperature, and the light flux on the breakdown voltage. With a light flux of less than a few watts per square meter and by varying the pressure near the critical temperature, the breakdown behavior of both helium and argon follows a Paschen curve. In low temperature helium (down to 5.2 K), a strong effect of the light on the breakdown voltage has been found. In contrast, no significant effect has been observed for the breakdown behavior in argon as well as in helium at temperatures higher than 250 K. Based on the results, we propose a phenomenological interpretation of the influence of photoemission on the breakdown mechanism.

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