

Review the enhancement of low frequency dielectric barrier discharge (DBD) plasmas generation by using Silicon Diodes for Alternating Current (SIDAC)

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We are reporting on enhancing low-frequency dielectric barrier discharge (DBD) plasmas generation using Silicon Diodes for Alternating Current (SIDAC). SIDAC is a bidirectional switching device designed to interface the power line directly. When the applied voltage meets or exceeds its breakover voltage (V_{BO}), the SIDAC will switch from the blocking state to the conducting state. The conducting state will continue until the main terminal current drops below the holding current (I_H). If the number of SIDACs in a series connection is N , the breakover voltage of this connection will be increased to N times, but the holding current (I_H) will be kept the same as the single one. When this connection is switched on, a sharp change of up to kV range in applied voltage with a rise time of several hundred nanoseconds will be generated.

Using high-voltage SIDACs with a conventional AC or DC power supply could offer a stepped change in the output due to the SIDACs' high-speed switching. Such stepped high-voltage operation can easily establish DBDs with low cost instead of expensive high-frequency power sources and pulse voltage power sources.

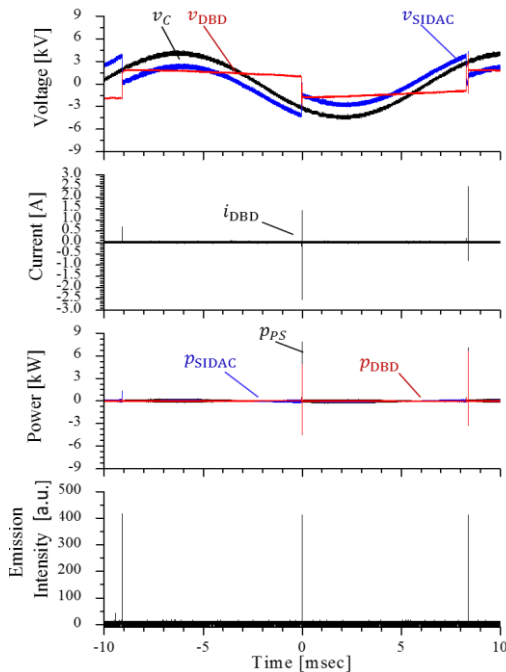


Fig.1 Discharge waveform using a low frequency AC voltage source

References

- [1] Hoa Thi Truong, Yoshihiko Uesugi, and Xuan Bao Nguyen, Mechanisms of low-frequency dielectric barrier discharge (DBD) plasma driven by unipolar pulses and bipolar pulses, AIP Advances 11, 025022 (2021)
- [2] Hoa Thi Truong, Yoshihiko Uesugi, Yasunori Tanaka, and Tatsuo Ishijima, "Effects of dielectric properties on electrical characteristics of dielectric barrier discharge generated by low frequency uni-polar high voltage pulses", Japanese Journal of Applied Physics 58, 111001 (2019).
- [3] Hoa Thi Truong, Misaki Hayashi, Yoshihiko Uesugi, Yasunori Tanaka and Tatsuo Ishijima, "Novel design of high voltage pulse source for efficient dielectric barrier discharge generation by using silicon diodes for alternating current", Review of Scientific Instrument, Vol.88, Iss.6, pp.065105, 2017
- [4] Yusuke Heira, Yoshihiko Uesugi, Yasunori Tanaka, Tatsuo Ishijima, "Characteristic Analysis of Low-Pressure Dielectric Barrier Discharges Generated by using Silicon Diode for Alternating Current", IEEE Transactions Fundamentals and Materials, Vol.135 No.3 pp.182-188, 2014 (Japanese)
- [5] Yujiro Sumiishi, Yoshihiko Uesugi, Yasunori Tanaka, and Tatsuo Ishijima, "Enhancement of Non-Equilibrium Atmospheric Pressure He Plasma Discharges by Using Silicon Diode for Alternating Current", Journal of Physics: Conference Series, Vol. 441, Iss. 1, ID. 012018, 2013

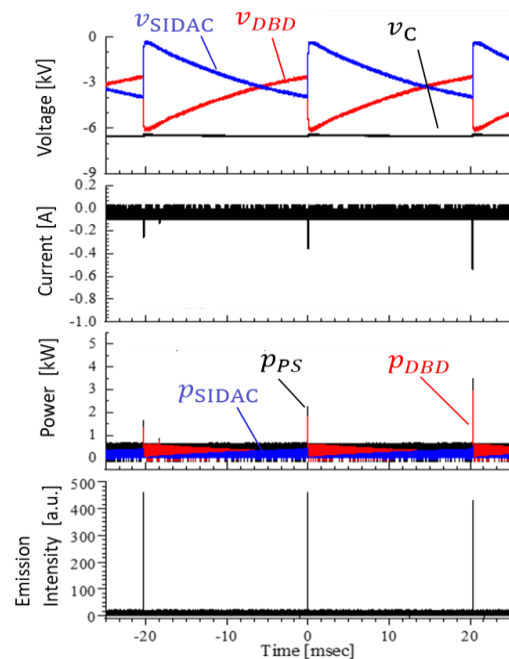


Fig.2 Discharge waveform using a DC voltage source