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Laser-Induced Gas Breakdown at KU-FEL

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Laser-induced breakdown has been observed in various combination of gases and lasers. It is known from previous studies that breakdown occurs when the number of electrons exceeds a threshold value through the following stages: generation of seed electrons, acceleration of electrons by inverse Bremsstrahlung, and avalanche multiplication of electrons by impact ionization.

We have observed laser-induced breakdown of gases at KU-FEL, the FEL oscillator at Kyoto University. In the thermionic cathode mode (2856 MHz repetition rate, 10 um), breakdown was observed in air, nitrogen, and argon, while no discharge was observed in the photocathode mode operation (29.75 MHz, 9 um). The difference in the two operation modes can be explained by the diffusion of electrons between the micropulses. This work was supported by MEXT Q-LEAP (JPMXS0118070271), IAE ZE Research Program (ZE2022B-23) and JSPS KAKENHI (22H03881).

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