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Effect of Electron Energy Distribution on the Hysteresis of Plasma Discharge: Theory, Experiment, and Modeling[1] HYO-CHANG LEE, Korea Research Institute of Standards and Science (KRISS), CHIN-WOOK CHUNG, Hanyang University — Hysteresis, which is the history dependence of physical systems, indicates that there are more-than-two stable points in a given condition, and it has been considered to one of the most important topics in fundamental physics. Recently, the hysteresis of plasma has become a focus of research because stable plasma operation is very important for fusion reactors, bio-medical plasmas, and industrial plasmas for nano-device fabrication process. Interestingly, the bi-stability characteristics of plasma with a huge hysteresis loop have been observed in inductive discharge plasmas Because hysteresis study in such plasmas can provide a universal understanding of plasma physics, many researchers have attempted experimental and theoretical studies. Despite long plasma research, how this plasma hysteresis occurs remains an unresolved question in plasma physics. Here, we report theory, experiment, and modeling of the hysteresis [Sci. Rep. 5, 15254 (2015)]. It was found experimentally and theoretically that evolution of the electron energy distribution (EED) makes a strong plasma hysteresis. In Ramsauer and non-Ramsauer gas experiments, it was revealed that the plasma hysteresis is observed only at high pressure Ramsauer gas where the EED deviates considerably from a Maxwellian shape. This hysteresis was presented in the plasma balance model where the EED is considered. Because electrons in plasmas are usually not in a thermal equilibrium, this EED-effect can be regarded as a universal phenomenon in plasma physics. e-mail:lhc@kriss.re.kr

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