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PIC and fluid simulations of capacitively coupled plasmas for dielectric etchers and microplasmas

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Fluid, particle-in-cell and hybrid models are the numerical simulation techniques are overviewed. The three modelling techniques are benchmarked by comparing simulation results in different plasma systems (plasma display panels [1], capacitively coupled plasmas [2]) with experimentally measured data. The potential profile and the electron kinetic information such as electron energy distribution and temperature are important for understanding the PDP striation phenomena. Kinetic 1d particle-in-cell/Monte-Carlo-collision modeling of the single- and dual-frequency capacitively coupled plasma (CCP) sources was also carried out in the wide parameter range. In particular, as the low- frequency current increases for the fixed high-frequency current in low-pressure dual radio-frequency argon discharges, the electron energy distribution function (EEDF) changes from Druyvesteyn to bi-Maxwellian type, along with the significant drop in the effective electron temperature. The EEDF evolution was shown to be attributed to the transition of the electron heating mode from collisional to collisionless heating in dual-frequency CCP [2]. *In collaboration with HC Kim (now at UC Berkeley), N Babaeva (now at Iowa State Univ.), F Iza, SS Yang, SJ Kim, M Radmilovic-Radjenovic, HJ Lee (Pusan National Univ.)

[1] Plasma Display Review, J.K. Lee and J. Verboncoeur, in Low Temperature Plasma Phys. ed. by R. Hippler et al., p. 367 (*Wiley- VCH 2001*).
[2] Mode Transition Induced by Low-frequency Current in Dual- frequency Capacitive Discharges, H.C. Kim and J.K. Lee, *Phys. Rev. Lett.* 93, 085003 (2004).