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Investigation of Pulse-Modulation Effect in Electron Beam Excited Plasma with Time Resolved Optical Emission Spectroscopy KEIGO TAKEDA, Graduate School of Eng., Nagoya Univ., TAKAYUKI OHTA, MASAFUMI ITO, Faculty of Systems Eng., Wakayama Univ., MASARU HORI, Graduate School of Eng., Nagoya Univ. — Micromachining of optical devices attracts much attention. In the process, the fast atomic-beam etching or the ion-beam etching has been employed, since the conventional reactive plasma etching can't be employed as the radio-frequency self-biasing is not efficiently supplied to the thick dielectric materials. However, a pulse-modulated electron-beam- excited plasma (EBEP) has a potential to realize the high etching rate without any additional bias power supply. Therefore, we have investigated the effect of pulse-modulation of EBEP using time resolved optical emission spectroscopy. Plasma was generated at a pressure of 0.27Pa and the fed gases were C_4F_8/Ar, a discharge current of 25A and an electron acceleration-voltage of 65V with a pulse-modulation frequency of 50kHz. It was found that CF_2 optical emission intensity at the 50%-duty ratio was involved in two lifetimes of τ_1=3 and τ_2=19.8μs compared with Ar optical emission intensity. Moreover, CF_2 radical density was evaluated by using Actinometry in order to compare with F atom density. F atom density increased with the increase of duty ratio, but CF_2 radical density decreased. Therefore, the dissociation degree of C_4F_8 was controlled by the duty ratio of electron acceleration voltage.

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