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Variation in photon-induced interface defects due to transient behavior of pulse modulated inductively coupled plasma Y. MIYOSHI, M. FUKASAWA, K. NAGAHATA, T. TATSUMI, Sony Semiconductor Solutions Corp., Z. LIU, Y. ZHANG, A. ANDO, K. TAKEDA, K. ISHIKAWA, M. SEKINE, M. HORI, Nagoya Univ. — It is important to reduce photon-induced interface defects generated in the plasma process for electronic device performance. In this study, we investigated the effect of transient behavior of a pulse-modulated ICP on these defects. The C-V analysis revealed the pulse frequency (0.5 – 20 KHz) dependence of the interface state density (D_{it}) in the SiN/Si interface whose variation was proportional to the UV fluence from discharge. By increasing the frequency, the D_{it} increased, was a maximum at 10 kHz, and then decreased. The D_{it} was lower than that in the CW at the lower frequencies, but was higher at the higher frequencies (>10 KHz). The transient behavior of the pulse plasma is presumed to be the cause of this property. The time resolved OES revealed that the optical emission overshoot appeared after ignition due to the variation in the electron temperature and number density in the early ON phase. The number of overshoots increased with increasing frequency. Therefore, the UV fluence and the D_{it} were increased. At the higher frequencies, the variation in the electron temperature and number density were suppressed due to the stepwise ionization via long-lived metastable species. Therefore the overshoot amplitude decreased. As a result, the UV fluence and the D_{it} were decreased. The results revealed that control of the transient behavior of pulse-modulated plasma is important to reduce photon-induced defects in the plasma process.

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