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Rotational Temperature Evolution in Non-Self-Sustaining DC Discharge Plasma Source for Nitrogen Vibrational Excitation[1] YUKI KUNISHIMA, KEISUKE TAKASHIMA, TOSHIRO KANEKO, Tohoku University — A Non-Self-Sustaining DC (NSS DC) discharge plasma source has been developed aiming for nitrogen fixation through nitrogen vibrational excitation. This plasma source is composed of two power sources; a nanosecond pulse plasma generator and a DC power supply. The apparent reduced electric field (E/N) suitable for efficient nitrogen vibrational excitation is controlled by the applied DC voltage. It is found that the NSS DC discharge can turn into self-sustaining discharge when the nitrogen power loading is significantly high ˜sub kW. This leads to loss of the apparent E/N control. Extension of the traveling distance of the ionization waves by the elongated nanosecond pulse width realize the NSS DC discharge at lower pulse repetition rates down to 3 kHz. This allows us to operate the NSS DC discharge at higher voltage without much increase in the discharge power loading and apparent E/N of 3 Td is achieved. The temporal change of the nitrogen rotational temperature is estimated from a nitrogen second positive emission band. Observed relatively minor gas temperature rise due to the DC power loading may suggest that most of the DC discharge power loading is used for the nitrogen vibrational excitation.

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