INFRARED EMISSION SPECTRUM OF He$_2$ OBSERVED BY A PULSED DISCHARGE

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The He$_2$ molecule is known to have many electronic transitions between Rydberg states in visible and ultraviolet regions. However, in infrared region only two bands $b^3\Pi_g - a^5\Sigma_u^+$ and $B^1\Pi_g - A^1\Sigma_u^+$ have been studied by using a DC discharge method so far. Recently we developed a time resolved Fourier transform spectroscopy with high resolution Bruker IFS 120 HR by using micro controller SX.

In the present study, the FT system was applied to infrared emission spectroscopy of He$_2$ which was produced by a pulsed discharge in He with pulse width of 20 μsec and 1 A peak-to-peak current. In the 1800-10000 cm$^{-1}$ region, many electronic transitions have been observed in addition to the previously reported two bands. From observed time profiles of emission spectra, Rydberg states with higher energy than the $b$ state are produced efficiently in afterglow plasma after termination of the discharge.

A least-squares analysis was carried out for the $h^3\Sigma_u^+ - g^3\Sigma_g^+$ and $g^3\Sigma_g^+ - d^3\Sigma_u^+$ bands in the 3200 cm$^{-1}$ region to determine the molecular constants. A transition from an un-identified state to the $d^3\Sigma_u^+$ state has been observed with irregular P- and R- branch intensities.

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