LASER-INDUCED FLUORESCENCE SPECTRA OF Ba^{+*}-He EXCIPLEXES IN COLD He GAS OF 3 – 30 K

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We have observed laser-induced fluorescence spectra of Ba^{+*}-He exciplexes for the first time. The experiment is carried out in an environment of cold gaseous helium at a temperature range of 3 – 30 K. It is found that the emission spectra of exciplexes observed by means of excitation of the $6p^2P_{3/2} \leftarrow 6s^2S_{1/2}$ (D2) transition of Ba^+ ions are red-shifted from the D2 emission line in the free space and are composed of several peaks. The experimental results are reproduced well by theoretical calculation of the emission spectra for vibrational levels of Ba^{+*}-He.

By use of the rate equation analysis of fluorescence intensities for Ba^{+*}-He and Ba^+, we have determined the collision-induced vibrational relaxation cross section of the $6p^2\Pi_{3/2}$ state to be $9.7 \pm 1.1 Å^2$ at 15 K. We have also found a peculiar feature in the temperature dependence of the exciplex formation and dissociation cross sections at the lowest part of the temperature.