

The CO₂ line shape in the far wing in the 8200-8300 cm⁻¹ spectral region

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Measurements of the CO₂ self-absorption were performed in the 8000 cm⁻¹ spectral region using a Bruker IFS-125 High-Resolution FTS and a 30 m base multipass gas cell [1] at pressures of 396, 612, 801 and 1004 mbar with a spectral resolution of 0.06 cm⁻¹ at temperatures of 286, 286, 287, 288 K, respectively.

In the 8000 cm⁻¹ spectral region there are among others two relatively strong bands with band heads. One of them has no CO₂ lines beyond the band head belonging to other CO₂ bands. This leads us to assume that absorption near the band head is due to strong line wings of the band at hand. The expression for the absorption coefficient in asymptotic line wing theory [2,3] includes two groups of parameters pertaining to the classical potential (governing the centre-of-mass motion) and to the quantum potential, or more exactly, to the difference between quantum interaction energies of states involved in a transition. The classical and quantum potential parameters are found from fitting the calculated absorption coefficients to experimental data.

It is concluded within the asymptotic line wing theory that the experimental and calculated results obtained for the CO₂ absorption coefficient in the wings of the two bands in the 8000 cm⁻¹ spectral region provide new information on the line shape at frequency detuning of several tens of half-widths. The line shape in the wing is shown to be different for different bands. For the bands with the same initial state, however, the parameters of the quantum potential appear to be close to each other.

[1] Yu. N. Ponomarev, T. M. Petrova, A. M. Solodov, A. A. Solodov, S. A. Sulakshin *Atmospheric and Oceanic Optics* 2011, 24, 726-728.

[2] L. I. Nesmelova, O. B. Rodimova, S. D. Tvorogov *Spectral line shape and Intermolecular Interaction*. Novosibirsk: Nauka. 1986.

[3] Ju. V. Bogdanova, O. B. Rodimova *J Quant Spectrosc Radiat Transfer* 2010, 111, 2298-2307.