Abstract Submitted
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Density of metastable O_2 ($b^1\Sigma^+$) molecules in an O_2 DC discharge measured by vacuum ultraviolet absorption and optical emission spectroscopy[1] JEAN-PAUL BOOTH, ABHYUDAY CHATTERJEE, OLIVIER GUAITELLA, LPP-CNRS, Ecole Polytechnique, Palaiseau, France, DMITRY LOPAEV, SERGEY ZYRYANOV, TATYANA RAKHIMOVA, DMITRY VOLOSHIN, YURI MANKELEVICH, Lomonosov Moscow State University, Russian Federation, NELSON DE OLIVEIRA, LAURENT NAHON, Synchrotron Soleil, Gif sur Yvette, France, COLIN WESTERN, Bristol University, UK — The number density of O_2 ($b^1\Sigma^+$) molecules in the positive column of a dc discharge in pure O_2 was determined by high-resolution vacuum ultraviolet (VUV) absorption of the ($4p\pi^1\Sigma_u^+ \leftarrow b^1\Sigma^+$) band at 131.3nm (using the Fourier Transform Spectrometer at the DESIRS beamline at Synchrotron Soleil) and from the absolute intensity of the A-band ($b^1\Sigma^+ v=0 \rightarrow {}^3\Sigma_g^-, v=0$) emission at 760nm. The 131.3nm absorption band is the only one that is well separated from O_2 X and a absorption bands. An analysis of the rotational structure of this heavily-perturbed band is presented as well as an $ab-initio$ calculation of the (previously-unknown) transition strength. The densities obtained by the two methods agree within 20%, confirming the accuracy of the transition strength calculation. The O_2 b density increases with O_2 pressure up 2 Torr (reaching about 1 % of the total gas density), then decreases at higher pressure. At low pressure the b density increases with discharge current, whereas the opposite trend is observed at high pressure. These observations can be explained by O_2 b quenching by O ^{3}P atoms with a rate that increases with temperature.

[1]Performed under LABEX Plas@par, ANR-11-IDEX-0004-02.

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