# Study of high temperature oxygen dissociation by the ARAS method

**Bystrov N S, Emelianov A V@, Eremin A V and Yatsenko P I**

Joint Institute for High Temperatures of the Russian Academy of Sciences, Izhorskaya 13 Bldg 2, Moscow 125412, Russia

@ aemelia@ihed.ras.ru

The dissociation of molecular oxygen plays an important role both in combustion processes and in the transfer of energy from a high-temperature flow to the surface of high-speed vehicles, and, consequently, to the vehicle construction. However, the rate constants of $O_2$ dissociation in modern combustion mechanisms differ by orders of magnitude, and this strongly affects the kinetics of combustion and requires clarification of their values in different temperature ranges. Therefore, new experimental data on the kinetics of $O_2$ dissociation at concentrations below $3\text{x}10^{13}$ $\text{cm}^{-3}$ should help to fill the existing gap. Most literature values of the $O_2$ dissociation rate coefficient were obtained in experiments on a kinetic shock tubes. For this, several measurement techniques were used, one of them is the method of atomic resonance absorption spectroscopy (ARAS), which allows direct measurement of the concentration of atomic oxygen in the range of $3\text{x}10^{11}$—$10^{14}$ $\text{cm}^{-3}$. The key point of this method is the need for an accurate calibration procedure to unambiguously match the measured oxygen uptake signal and their absolute concentration. In this work, for the first time, a wide-range calibration of the measured signal of absorption by oxygen atoms from their absolute concentration is performed taking into account the dependence of the absorption cross section on temperature. This precise calibration were used to measure the time profiles of concentration of atomic oxygen behind the shock wave and, to extract the exact values of the rate constants for the dissociation of $O_2$ at temperatures from 3000 to 5000 K and pressures from 1.5 to 3 atm. The results obtained are compared with the existing literature data. This study was funded by RFBR-DFG project No. 20-58-12003.