Atomic resonance absorption spectroscopy study of kinetics of dimethoxymethane oxidation at high argon dilution behind shock waves

Emelianov A V[1], **Kurbatova E S**[1,2,@] **and Yatsenko P I**[1]

[1] Joint Institute for High Temperatures of the Russian Academy of Sciences, Izhorskaya 13 Bldg 2, Moscow 125412, Russia
[2] Moscow Institute of Physics and Technology, Institutskiy Pereulok 9, Dolgoprudny, Moscow Region 141701, Russia

[@] kurbatova.es@phystech.edu

In recent times, oxygenated fuels have attracted researchers attention due to reduction of carbon monoxide and soot emission. Polyoxymethylene dimethyl ethers (oxymethylene ethers, OME_n) have been identified as potential diesel fuel candidates. Nevertheless, understanding of the oxidation chemistry of OME_n is poor. Due to this, much attention has been paid to the oxidation of the simplest OME, dimethoxymethane (DMM, methylal, CH_3–O–CH_2–O–CH_3), since this molecule serves as a model molecule to elaborate combustion models of longer oligomers. However, the experimental data on the DMM oxidation available in the literature are still insufficient, especially at high temperatures. In this regard, the major goal of this work is an experimental study of kinetics of dimethoxymethane oxidation at high temperatures of 1800–3200 K and pressures of 1.8–2.5 bar. All experiments were carried out behind reflected shock waves on a high vacuum kinetic shock tube in highly Ar diluted mixtures of 5–50 ppm DMM + 10 ppm N_2O. The quantitative measurements of the time profiles of the concentration of oxygen atoms in the ground electronic state $O(^3P)$, consumed during the oxidation of DMM, were performed using the precise method of atomic resonance absorption spectroscopy (ARAS) in the vacuum-uv region of the spectrum at the resonant line of an oxygen atom at 130.5 nm. The obtained experimental data made it possible to carry out validation of existing kinetic models of OME_n oxidation at high temperatures and develop recommendations for their subsequent refinement.