Kinetics of dimethyl ether high-temperature oxidation: experiment and numerical simulation

Bystrov N.S.[1], **Emelianov A.V.**[1], **Kurbatova E.S.**[1,2,@] **and Yatsenko P.I.**[1,3]

[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, 141701, Russia
[3] Bauman Moscow State Technical University, 2nd Baumanskaya Street 5, Moscow, 105005, Russia

[@] kurbatova.lz@yandex.ru

Dimethyl ether (DME, CH_3OCH_3) is the zero representative of the polyoxymethylene dimethyl ethers (OME_n). These compounds are considered as promising fossil fuels additives. For better understanding of its combustion properties, reliable data on dimethyl ether oxidation is crucial: many reaction rate constants in OME submechs are estimated by analogy with those for DME. In this regard, the major goal of this work was a comprehensive study of the kinetics of high temperature dimethyl ether oxidation. An experimental part was carried out behind reflected shock waves on a high vacuum kinetic shock tube by observing the most important combustion radicals. Time-resolved concentration profiles of atomic oxygen were measured via the precise method of atomic resonance absorption spectrometry (ARAS) at 130.5 nm, which corresponds to the $^3P_{2,1,0} \rightarrow ^3S_1$ transition of O atom. Emission profiles of electronically excited OH radicals ($A^2\Sigma^+ \rightarrow X^2\Pi$) were measured in the band near 308 nm. Overall experimental conditions implemented in this work are mixtures of 5–10 ppm DME + 15–30 O_2 + Ar, temperatures of 1500–3000 K and pressures of 2–3 bar. Obtained experimental data was used to validate current kinetic models. Based on the comparison results, it was found that the existing DME oxidation models require further improvements to increase their predictive ability. This work was supported by RSCF grant No 25-79-00008.