Soot formation in a standard premixed ethylene/air flame diluted by dimethyl ether

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In this study the results of the investigation of soot formation in a standard premixed ethylene/air flame with the addition of 15-60% dimethyl ether are presented. The soot volume fraction was measured using the laser light extinction method at a wavelength of 520 nm. The flame temperature versus height above a burner was measured using standard Pt-Rh thermocouples. It was shown that the addition of 15% dimethyl ether to ethylene/air flame resulted in a 20% increase of soot volume fraction. The further replacement of ethylene by more than 30% dimethyl ether decreased the soot volume fraction an order of magnitude relatively to a pure ethylene/air flame. Kinetic modeling of soot volume fraction growth with height above a burner was carried out based on the kinetic mechanisms developed by CRECK group (http://creckmodeling.chem.polimi.it/). The calculations were carried out using open software package OpenSMOKE ++, which includes the modelling of gas-dynamic processes in the premixed laminar flame reactor. Good agreement between the experimental and calculated data was obtained. The analysis of kinetic mechanism used in this study obtained allowed determining the peculiarity of kinetic pathways of soot volume fraction growth at different additions of dimethyl ether to ethylene/air flame. The results obtained in a standard flame could be used for development and validation of various kinetic mechanisms of soot formation. This study was funded by RFBR-DFG project No. 20-58-12003.