Experimental and computational study of soot formation in premixed laminar acetylene-air and propylene-air flames

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In this study the results of the investigation of soot formation in premixed laminar acetylene/air and propylene/air flames are presented. The flames were stabilized on a standard McKenna burner, which represents a flat premixed laminar flame burner equipped with the appropriate infrastructure and diagnostic tools for experimental measuring of the flame temperature and the volume fraction of the forming condensed phase. The flame temperature versus height above a burner was measured using special design B-type (Pt-Rh) and K-type (chromel-alumel) thermocouples of our own production. The soot volume fraction was measured using laser light extinction method at a wavelength of 520 nm. Kinetic modeling of soot volume fraction growth versus 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 1D modelling of gas-dynamic processes in the premixed laminar flame reactors. Based on the comparison of the obtained results, the satisfactory agreement between the experimental and calculated data for both studied flames could not be obtained. This result indicates that modern kinetic mechanisms do not adequately describe soot formation in acetylene and propylene flame combustion well and need to be improved.