



THE APPLICATION OF THE TALBOT-IMAGES METHOD TO THE METHANE-AIR FLAME DIAGNOSTIC

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ABSTRACT

The article describes the experimental system based on the Talbot effect which is used for measurements of average concentrations of major species in a methane-air reacting axisymmetric flow. In the paper the principles of Talbot effect-based technique for analysis of optical inhomogeneity are discussed and the optical scheme for the technique is represented. The connection between experimental Talbot images and characteristics of the investigated flow is indicated. The results of nonintrusive measurements for axisymmetric reacting methane-air jet issuing from the nozzle with a critical cross-section diameter 4 mm are reported. The velocity of the jet of methane at the nozzle exit was approximately 11 m/s. The experimental investigation was included to the examination of the flow in 6 different wavelengths. Long-exposed Talbot images of the jet were obtained and were used to calculate the distribution of time-averaged refractive index with a high spatial resolution. The obtained dispersion relation for the averaged refractive index of the jet was used to calculate the temperature field and concentration fields of basic components: N_2 , O_2 , H_2O , CO_2 , CO , CH_4 . The paper illustrates the application of Talbot effect-based method for experimental diagnostic of reacting gas flows.

Keywords: Talbot effect, flame diagnostic, methane, reacting methane flow