ESTIMATION OF TIME PARAMETERS OF COAL PARTICLE COMBUSTION IN AIR FLOW UNDER THERMAL RADIATION

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Although renewable energy sources are becoming increasingly important for future energy systems, coal combustion is still the dominant source for power generation in some regions. Nowadays it is necessary to perform the modernization of outdated power plants in order to decrease the emissions of various hazardous trace elements and to implement a new effective coal combustion technology. For such modernizations, novel construction approaches and new materials for burners are often used. The study of effective combustion of fossil fuels is important for finding optimal regimes for burning coal particles in various domestic and industrial boilers and power plants.

In this work, thermal decomposition and time parameters of a coal dust combustion were studied. The numerical investigations were performed using standard formulas and some simple models like the shrinking core model and etc.. Experiments were carried out using a laboratory-made setup described in [1]. In the laboratory-made setup the thermal radiation used for coal particles decomposition and ignition was emitted by porous burner during propane/butane combustion. The porous cylindrical Ni-Al alloy burner prepared by self-propagating high-temperature synthesis was used as external heater [2]. Such type of heater was chosen because of its high radiative and heat flux density [3].

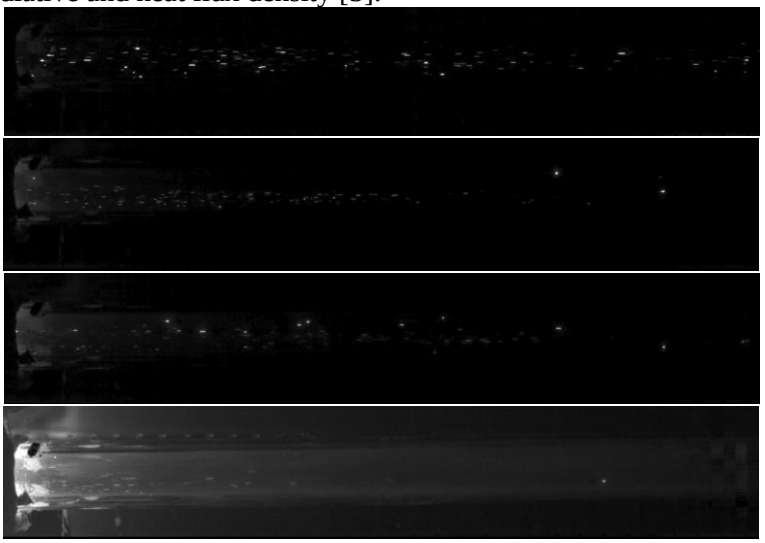

Fig.1. Images of ignited coal particles recorded by the high-speed camera in the outlet of porous burner in dependence of the calculated heat release of the internal surface of the burner: a – 395 kW/m^2, b – 448 kW/m^2, c –475 kW/m^2, d – 1052 kW/m^2.

Of particular interest is the prediction of char properties, such as composition, surface areas, and morphology, since these impacts on char combustion. This information is also important for the gasification systems development [4]. The processes of devolatilization, char formation, and heterogeneous oxidation depend on temperatures and a heating-up rate. In this work we carried out the numerical calculations of burnout times and heating-up times of particles before ignition. All calculations were based on experimental parameters and results.

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