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MODELING OF GAS-PARTICLE TWO-PHASE TURBULENT FLOW WITH GAS MASS SOURCE

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The aim of this work is to investigate the solid particles - gas interactions. For this purpose numerical modeling was carried out by means of a commercial code for simulations of two-phase dispersed flows with in-house models accounting for mass and density change of solid phase. In the studied case the particles are treated as spherical moving grains carried by a swirling stream of hot gases. Interactions between ,,cold" solid phase and ,,hot" gas phase may lead to shape, mass (Tomeczek, 1992) and volume changes (Fu et al., 1992). Those parameters have an impact on the aerodynamic properties determining for example the residence time of particles in combustion chamber. Mass exchange between solid particle and surrounding gases results in the additional mass, momentum and energy source in flow, moreover violent volume changes of the particle may significant modify its trajectory. The modeling of turbulence in that case becomes an important issue. The values of particles concentrations or velocity field of continuous phase become significant informations. Described problem is a real practical phenomenon. Dispersed phase flow with changing mass and density of the solid phase, it is for example pulverized coal combustion in a real industry boilers.

In this work numerical simulations were performed for turbulent regime, using two methods for turbulence modeling: RANS (2 equation k-ε) model and LES. In the calculations the own numerical models for particle mass and particle density were taken into account. These models were obtained basing on the experimental data, received from Institute for Chemical Processing of Coal in Zabrze (Sciążko, 2005). In determination of solid phase mass loss rate (defined by the pyrolysis progress *Z*), the temperature field and the physical properties of solid particles were taken into consideration (Fig.1). The models include also the

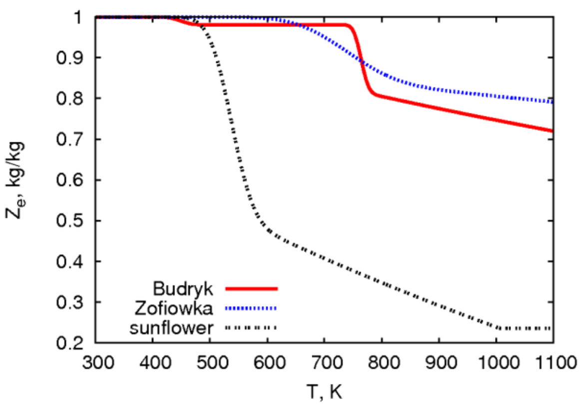

***Fig.1**. Mass loss of the particle measured during heating, thermogravimetric data*

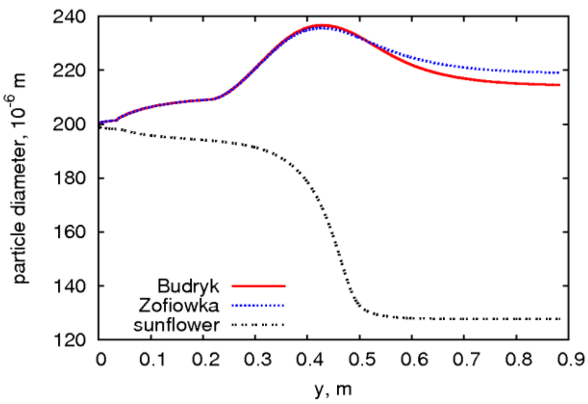

***Fig.2.** Particle diameter for different materials in the function of the distance from the inlet to the combustion chamber (RANS).*

diameter changes as a result of the particle heating from the hot surrounding hot gases (Fig.2). The appropriate conditions for the heat and mass transfer between gas and solid phase were obtained by different temperatures of inlet streams.

In the paper the analysis of the influence of the physical properties changes and the type of turbulence modeling on flow parameters of swirled mixture (gases and solid phase) were taken into consideration. The results of these simulations were presented and compared.

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