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Dissertation title

Analysis of heat transfer process obtained from solid fuel burning in fixed bed conditions

Abstract

The topic of the dissertation was connected with an analysis of the influence of heat transfer phenomena, obtained during solid fuel burning in fixed bed conditions. Heat transfer phenomena were analyzed for three chosen thermal objects, which represented different types of installations used in industrial and domestic applications. Conducted research was oriented on the determination of the heat transfer phenomenon, that occurred in chosen thermal installations, depending on the real heat load. During the research, the possibility of thermal efficiency improvement of the mentioned installations was analyzed. Conducted analysis allowed to determine a character of exhaust gas flow for heat transfer processes. During the research chosen elements of analyzed installations were designed. Three heat transfer CFD models were prepared by application of the Ansys Fluent software. The last part of the research was connected with CFD modeling of solid fuel burning in fixed bed conditions. The fuel burning model was validated during the experimental part of the research. A test stand used during the experimental part of the research was designed by the author of the thesis. Conducted work was oriented on the designation of the heat transfer phenomena and possibilities of thermal efficiency improvement in selected thermal installations. During the research, an exhaust gas flow analysis through chosen heating devices was conducted. It allowed for concluding an influence of the character of a flow and various heat loads of the heating devices for the heat transfer processes. Also, the influence of primary solid fuels substitution by renewable solid fuels for a heat transfer phenomena was analyzed. The distribution of heat flux and heat transfer coefficients as a function of the distance from the fuel bed was analyzed. It allowed determining radiation and convection participation in a heat transfer process as a function of the heat load of the analyzed thermal devices.