THERMAL DECOMPOSITION AND COMBUSTION OF COMPOSITE PELLETIZED FUELS

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Abstract: The results of experimental studies of the characteristics of thermal decomposition, ignition, and combustion in a high-temperature environment of composite fuel pellets based on various groups of waste are presented. The experiments were carried out on an experimental setup which included a muffle furnace and a Phantom Miro C110 high-speed video camera. Thermal decomposition characteristics were determined using a METTLER-TOLEDO TGA/DSC 3+ thermogravimetric analyzer. The main recorded characteristics of the process: delay times of gas-phase and heterogeneous ignition and combustion duration. It has been established that the greatest differences in the ignition and combustion characteristics of pellets with additives of cardboard and coal slime are observed at low (less than 800 °C) temperatures of the oxidizing environment in the combustion chamber. The smallest gas-phase ignition delays are characterized by pellets "100% sawdust" (7.58–2.15 s at the oxidizing temperature of 700–900 °C), and the longest — "85% sawdust, 15% cardboard"' (15.43 s at the oxidizing temperature of 700 °C) and "85% sawdust, 15% coal slime" (7.85 s at the oxidizing environment temperature of 900 °C).

Keywords: pelletized fuels; coal preparation waste; ignition delay times; combustion duration

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Figure Captions

Figure 1 Schematic of the experimental setup for determining the ignition and combustion characteristics

Figure 2 Appearance of the fuel pellets under study: *1* — 100% sawdust; *2* — 95% sawdust, 5% coal slime; *3* — 90% sawdust, 10% coal slime; *4* — 85% sawdust, 15% coal slime; *5* — 95% sawdust, 5% cardboard; *6* — 90% sawdust, 10% cardboard; and *7* — 85% sawdust, 15% cardboard

Figure 3 TG-DTG curves of the studied fuel pellets: *1* — 100% sawdust; *2* — 90% sawdust, 10% cardboard; and *3* — 90% sawdust, 10% coal slime

Figure 4 Dependences of the delay times of gas-phase (*a*) and heterogeneous (*b*) ignition and the combustion duration (*c*) of the studied fuel pellets with cardboard additives on the temperature in the combustion chamber: *1* — 100% sawdust; *2* — 95% sawdust, 5% cardboard; *3* — 90% sawdust, 10% cardboard; and *4* — 85% sawdust, 15% cardboard

Figure 5 Dependences of the delay times of gas-phase (*a*) and heterogeneous (*b*) ignition and the combustion duration (*c*) of the studied fuel pellets with coal slime additives on the temperature in the combustion chamber: *1* — 100% sawdust; *2* — 95% sawdust, 5% coal slime; *3* — 90% sawdust, 10% coal slime; and *4* — 85% sawdust, 15% coal slime

Table Captions

Table 1 Proximate and ultimate analyses of fuel components

Table 2 Characteristics of thermal decomposition of the studied fuel pellets

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