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Mathematical model simulating the ignition of a droplet of coal water slurry containing petrochemicals

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## ACCEPTED MANUSCRIPT

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2		petrochemicals
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11		
12	Absti	act
13	Globa	al problems of effective coal and oil processing waste recovery can be solved by making use of
14	these	wastes as the main fuel components for coal water slurries containing petrochemicals
15	(CWS	SP). Until now, no predictive models have been developed that would simulate the sustainable
16	igniti	on of CWSPs based on components with highly different properties, such as ash, moisture, and
17	volati	le content, heat of combustion, etc. This is exactly the type of model we are presenting in this
18	paper	. In order to gain a greater insight in the process under study, the experimental research has
19	been	conducted. We have created an experimental database with the main characteristics of CWSP
20	igniti	on, namely the duration of stages, gas-phase and heterogeneous ignition delay times,
21	maxir	num combustion temperatures, and minimum sufficient oxidizer temperatures. A
22	mathe	ematical model has been developed predicting the conditions and characteristics of CWSP
23	drople	et ignition. The signature feature of the model is that it accounts for all the main heat and mass
24	transf	er processes and chemical reactions in the <i>solid fuel – liquid fuel – water</i> system under study.
25	This	mathematical model can serve as the basis for estimating and comparing the ignition
26	chara	cteristics of different CWSPs.
27	Keyw	vords: coal water slurry containing petrochemicals; coal and oil processing wastes; hot air;
28	igniti	on; mathematical model.
29		
30	Nome	enclature and units
31	С	heat capacity, J/(kg·K)
32	С	concentration
33	D	diffusion coefficient, m <sup>2</sup> /s
34	Ε	activation energy, J/(mole·K)
35	$h_d$	parameter of the smearing of the front, m
36	k	pre-exponential factor, 1/s
37	$K_{\rm P}$	permeability of porous structure, m <sup>2</sup>
38	l	effective pore size, m
39	т	porosity
40	р	pressure, Pa
41	Q	enthalpy of process, J/kg
42	R	radius, m
43	Rout	outer radius, m
44	$R_t$	perfect gas constant, J/(mole·K)
45	Т	temperature, K

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