

TWO-DIMENSIONAL MODEL OF FINGERING INSTABILITY IN SMOLDER COMBUSTION OF THIN SOLID FUEL IN AIR FLOW

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Abstract: The frontal propagation of smolder combustion of thin solid fuel in air flow in a narrow channel is considered. It is shown that the governing process that determines the propagation of the smolder combustion front is the diffusion of oxygen in flow and its absorption by the front. A two-dimensional diffusion model of propagation of the smolder combustion front has been considered and the equations describing front propagation have been obtained. The stability of the planar smolder combustion front is investigated. It is shown that the front is stable if it propagates in the same direction as the air flow; in this case, the perturbations of the front decay exponentially. If the smolder combustion front propagates in the direction opposite to air flow, the front perturbation amplitude grows exponentially; it can result in front fingering.

Keywords: smolder combustion; fingering instability; thin solid fuel; diffusion

Acknowledgments

The work was supported by the Russian Foundation for Basic Research (grant No. 16-01-00557).

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Received June 19, 2017

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