IGNITION OF METHANE/AIR MIXTURE IN THE PRESENCE OF THE COAL DUST UNDER TEMPERATURES 800–1200 K

V. V. Leschevich, O. G. Penyazkov, and S. Yu. Shimchenko

A. V. Luikov Heat and Mass Transfer Institute, National Academy of Sciences of Republic of Belarus, 15 P. Brovki Str., Minsk 220072, Republic of Belarus

Abstract: The paper contains the results of experimental study of ignition of the stoichiometric methane–air mixture in presence of coal particles 20–32 μm in diameter under temperatures 950–1050 K and pressures 1.5–2.0 MPa. These conditions were created by a rapid compression machine. It was found that ignition of particles occurs at temperatures of the oxidative medium higher than 850 K. Burning particles reduce the ignition time and the ignition temperature of the methane–air mixture at temperatures exceeding 1000 K. The temperature of coal particles burning in methane–air mixture and in air environment heated by compression was measured. The mean temperature of particles was 2500 K. It indicates the possibility of premature ignition of gas mixture heated by compression to temperatures 1000–1100 K by addition of coal particles.

Keywords: methane; coal dust; rapid compression machine; ignition

Acknowledgments

This work was partially supported by BRFFR (grants F14R-184 and F15RM-044).

References

1. Nagy, J., and D. W. Mitchell. 1963. Experimental coal–dust and gas explosions. RI 6344: U.S. Bureau of Mines.
2. Amyotte, P. R., K. J. Mintz, M. J. Pegg, and Y. H. Sun. 1993. The ignitability of coal dust–air and methane – coal dust – air mixtures. *Fuel* 72:671–679. doi: 10.1016/0016-2361(93)90580-U.
3. Krivosheyev, P. N., V. V. Leschevich, O. G. Penyazkov, and S. Yu. Shimchenko. 2014. High-speed imaging of premature ignition in rapid compression machine. *Advances in nonequilibrium processes: Plasma, combustion, and atmosphere*. Eds. A. M. Starik and S. M. Frolov. Moscow: TORUS PRESS. 137–147.
4. *Chelliah, H. K., F. J. Miller, A. Kelley, A. Mercado, and B. Warfield*. 2005. Heterogeneous combustion of porous carbon particles under normal and reduced gravity conditions. *4th Joint Meeting of the U.S. Sections of the Combustion Institute*.

Received December 18, 2015

Contributors

Leschevich Vladimir V. (b. 1983) — research scientist, A. V. Luikov Heat and Mass Transfer Institute, National Academy of Sciences of Republic of Belarus, 15 P. Brovki Str., Minsk 220072, Republic of Belarus; V.Leschevich@dnp.itmo.by

Penyazkov Oleg G. (b. 1961) — Academician of the National Academy of Sciences of Republic of Belarus, Doctor of Science in physics and mathematics, director, A. V. Luikov Heat and Mass Transfer Institute, National Academy of Sciences of Republic of Belarus, 15 P. Brobki Str., Minsk 220072, Belarus; penyazkovoleg@gmail.com

Shimchenko Sergey Yu. (b. 1990) — junior research scientist, A. V. Luikov Heat and Mass Transfer Institute, National Academy of Sciences of Republic of Belarus, 15 P. Brovki Str., Minsk 220072, Republic of Belarus; Sergey.Shimchenko@gmail.com