INHIBITION OF COMBUSTION AND EXPLOSION OF METHANE–AIR MIXTURES IN THE PRESENCE OF COAL DUST

V. M. Prokopenko, S. K. Abramov, and V. V. Azatyan

Institute of Structural Macrokinetics and Materials Science, Russian Academy of Sciences, Chernogolovka, Moscow Region 142432, Russian Federation

Abstract: It is shown that the combustion and explosion of methane–air mixtures occur only due to implementation of chain avalanche, regardless of the presence or absence of coal dust. It is established that the flame propagation with the addition of coal dust becomes progressively accelerating. The conclusion that pulverized coal promotes combustion and is able to initiate explosion has been made.

Keywords: chain reaction; an intermediate particle; inhibitor; coal dust

Acknowledgments

This work was supported by the Program No. 24P of the Presidium of the Russian Academy of Sciences and by the Russian Foundation for Basic Research (grant No. 14-03-00092a).

References

1. Demidov, P. G. 1975. *Gorenie i svoystva goryuchikh veshchestv* [Combustion and properties of combustible materials]. Moscow: Higher engineering fire-technical school of MIA of the USSR. 280 p. (In Russian.)
2. Korol'chenko, A. Ya. 1986. *Pozharovzryvobezopasnost' promyshlennoy pyli* [The industrial dust explosion safety]. Moscow: Chemistry. 216 p. (In Russian.)
3. Azatyan, V. V. 2011. Scientific foundations and effective chemical methods of combustion, explosion, and gas detonation control. *J. Phys. Chem. A* 85(8):1293–1306.
4. Azatyan, V. V., S. K. Abramov, and V. M. Prokopenko. 2012. Inhibition of steady-state detonation of hydrogen–air mixtures by propane. *Dokl. Phys. Chem.* 447(2):216–219.
5. *Svod pravil: Sistemy protivopozharnoy zashchity, ustanovki pozharnoy signalizatsii i pozharotusheniya avtomaticheskie, normy i pravila proektirovaniya* [A set of rules: Fire protection system, installation of fire alarm and fire extinguishing, standards and design rules]. 2009. Moscow: Russian Ministry of Emergency Situations.
6. Lewis, B., and G. Von Elbe. 1987. *Combustion, explosions and flame in gases*. New York, NY–London: Acad. Press. 592 p.
7. Semenov, N. N. 2005. *Izbrannye trudy* [Selected works]. Moscow: Nauka. Vol. 3. 499 p.

Received December 18, 2015

Contributors

Prokopenko Vyacheslav M. (b. 1948) — Candidate of Science in physics and mathematics, senior research scientist, Institute of Structural Macrokinetics and Materials Science, Russian Academy of Sciences, 8 Academician Osypy'an Str., Chernogolovka, Moscow Region 142432, Russian Federation; vprok48@mail.ru

Abramov Sergey K. (b. 1956) — junior research scientist, Institute of Structural Macrokinetics and Materials Science, Russian Academy of Sciences, 8 Academician Osypy'an Str., Chernogolovka, Moscow Region 142432, Russian Federation

Azatyan Vylen V. (b. 1931) — Corresponding Member of the Russian Academy of Sciences, Doctor of Science in chemistry, head of laboratory, Institute of Structural Macrokinetics and Materials Science, Russian Academy of Sciences, 8 Academician Osypy'an Str., Chernogolovka, Moscow Region 142432, Russian Federation; azatyan@ism.ac.ru