conference. – Tomsk: Tomsk Polytechnic University, 2012.
3. Tsiguleva O. 2014. *Foreign languages as a tool of development professional mobility of a future specialist.* In International Journal of Multidisciplinary Thought. Vol. 04, No. 02, 2014. Copyright by University Publications.net., p. 89-95.
4. Available from: http://itesj.org/Articles/htm/ [Accessed 05.09.2014].
5. Available from: http://en.wikipedia.org/wiki/Public_speaking/ [Accessed 05.09.2014].

EXPERIMENTAL RESEARCH OF THE DISPERSED WATER DROPLETS COLLISION IN HIGH TEMPERATURE GAS AREA

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Annotation. An experimental research of collision processes droplets (size from 0.05 mm to 1 mm) in the flame dispersed water (temperature is about 1100 K). The characteristic mode of the water droplets collision in their motion in high temperature gas area. Characteristics of processes droplet collisions are identified by means of modern high-speed diagnostic systems followed by coagulation, dispersal or fragmentation.

Keywords: water droplets, high-temperature gases, coagulation, impact, fragmentation.

Introduction. At the present time due to the technological progress fire safety is very urgent. The main objective of various development and research is improvement of the efficiency of means and methods of firefighting. The most common method of fighting fires is dispersed water in the fire zone. In recent research the main attention is given to these parameters: mutual arrangement of atomizer, spray rate, water consumption, dispersed water.

Absolutely, the fact that droplets are subject to numerous processes collisions is not taken in attention. It is capable of a different effect on the efficiency of extinguishing fires: reduce the time of fire suppression, increase the consumption of dispersed water droplets.

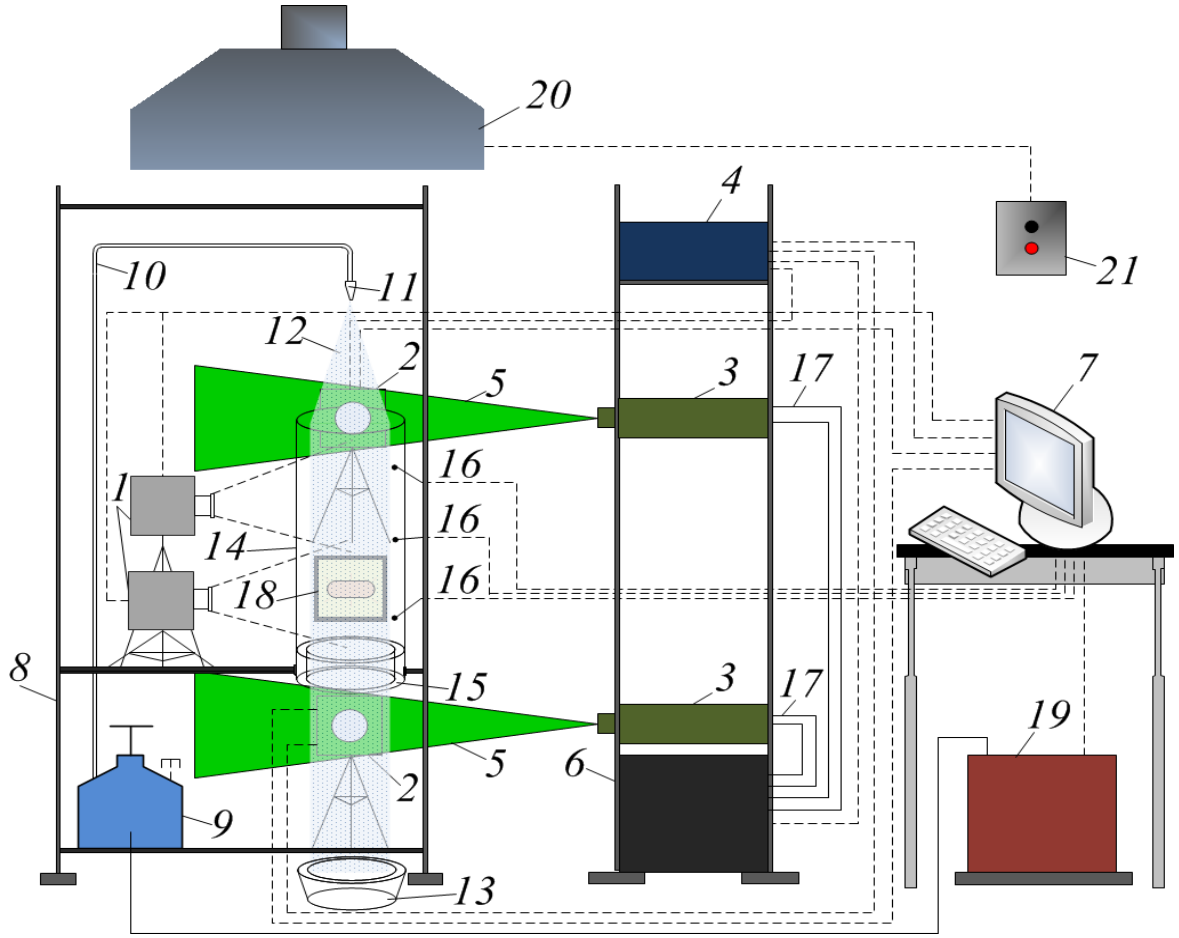
The goal of the present work is to study experimentally the determination of the probability of occurrence of one of the characteristic modes of water droplets collisions as they move in a stream of high-temperature gases.

Experimental technique. The experimental setup was used and its scheme shown on Figure 1 (a, b). The basic elements of the setup are: cross-correlation digital camera (figure format – 2048x2048 pixel, frame frequency – 1.5Hz, minimal delay between two sequence figures – 5ms), double pulsed solid-state laser (with active sphere “yttrium aluminum garnet” and neodymium additives, wave-

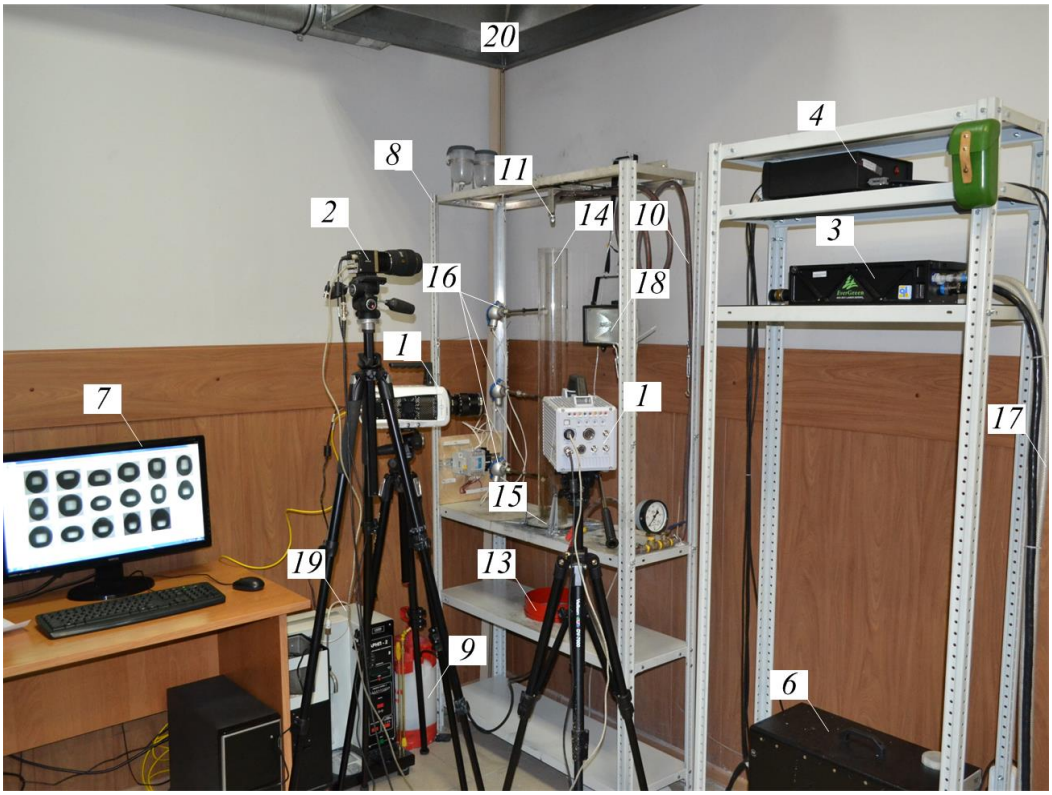
length – 532nm, minimum energy in impulse – 70mJ, maximum impulse time – 12ns, recurrence frequency – 15Hz), synchronizing processor (maximum signal sampling – 10ns).

Water with special inclusions “tracers” was used as studied extinguishing liquid. “Tracers” are the mixture (0.5% in weight) of titanium dioxide nanopowder. Inclusions were added for contrast increase of videograms received with cross-correlation digital camera.

Particles TiO2 were chosen as “tracers” because they are not dissolved in water and practically are not influenced on water evaporation characteristics [11-14]. Particles of TiO2 with characteristic sizes from 80 nm to 130 nm (chosen range is due to claims [15-18] of panoramic optical methods PIV and IPI) were used in experiments.



a



b

Figure 1. Scheme (a) and appearance (b) of the experimental setup: 1 - high speed video camera; 2 - cross-correlation chamber; 3 - double solid-state pulsed laser; 4 – PC Synchronizer, camera and the laser cross-correlation; 5 - light "knife"; 6 - generator of the laser radiation; 7 - PC; 8 - state; 9 - container with water; 10 - water supply passage; 11 - spray; 12 - water spray; 13 - collector; 14 - cylinder of heat-resistant translucent material; 15 - hollow cylinder, the inner space of which is filled with a flammable liquid; 16 - thermocouple; 17 - channel traffic coolant laser; 18 - spotlight; 19 - heating installation; 20 - pressure system; 21 - remote on / off injection system

High-speed camera Photron FASTCAM SA1 is used for motion of collision of two drops of water. The camera makes video recording of the collision of drops in different registration areas. Then, using special software «TemaAutomotive» the procedure for processing of video frames is realized which determine the mode of collision of water droplets, as well as assessing the impact of velocity (u_{m1}, u_{m2}) and sizes (r_{m1}, r_{m2}) on the result of the collision.

Results and discussion. This study revealed the characteristic modes of collision of drops: coagulation (fusion), split (the formation of more than three drops significantly smaller then initial size) and expansion (the formation of two drops with characteristic dimensions which are close to initial). Video recordings of experiments with the image of coagulation and cleaving flying droplets during their movement in the flow of hot gases are implemented.

The analysis of more than 1,000 videograms of conducted experiment allowed us to determine the probability of each of the three effects of collisions. In the numerical analysis of the results of experiment the parameters: $P_1 = N_1 / (N_1 + N_2 + N_3)$, $P_2 = N_2 / (N_1 + N_2 + N_3)$, $P_3 = N_3 / (N_1 + N_2 + N_3)$, where N_1, N_2, N_3 - number of collisions in which first, second and third embodiments of collisions are realized.

Figure 2 shows typical values of the criteria P_1 (coagulation), P_2 (expansion) and P_3 (split) when adjusting the speed of the colliding drops. It is clearly seen (Figure 2) that the probability of occurrence of the coagulation process is high at low speeds and decreases with increasing speed of the water droplets.

This is due to the excess viscous forces over inertial forces. With the growth rates of water droplets probability of scattering processes (P_2) and fragmentation (P_3) increases, and at one point the probability of occurrence of each process is equal (equal opportunities). This point corresponds to the speed of the water droplets u_{m1} = 9-11 m /s.

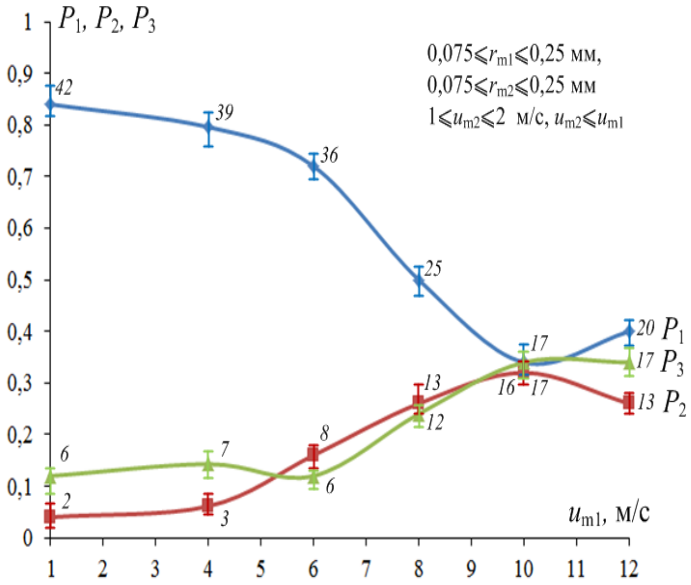


Figure 2. Statistics of occurrence of each of the three effects of the collision of two drops when one's speed of movement is changing: P_1 - coagulation, P_2 - expansion, P_3 - fragmentation

Conclusion. The study identified three characteristic regimes of collision: coagulation, fragmentation and dispersal. Basic characteristics (r_{m1}, r_{m2}, u_{m1}, u_{m2}) of collision of water droplets in the flow of high temperature gases are established. It is found that all the characteristics in some way affect the mode of collision. At low speed of coagulation is high, at higher frequencies the realization of processes of crushing and expansion increases. The obtained results illustrate the feasibility of allowing three modes of collision in the formulation of mathematical expressions for the basic characteristics of droplets, as well as more efficient use of droplet flow ensuring fire safety and fire fighting.

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REFERENCES
1. Терехов, В. И., Пахомов М. А. Тепломассоперенос и гидродинамика в газокапельных потоках. – Новосибирск: Изд-во НГТУ, 2009. – 284 с.
2. Алеханов, Ю. В., Близнецов, М. В., Власов, Ю. А. Письма в ЖТФ. – Т. 29. – № 6. – 2003. – С. 1-6.
3. Волков, Р. С., Кузнецов, Г. В., Стрижак, П. А. ЖТФ. – Т. 84. – № 7. – 2014. – С. 15-23.
4. Кузнецов, Г. В., Стрижак, П. А. ТВТ. – Т. 52. – № 4. – 2014. – С. 597-604.

РАЗВИТИЕ НАВЫКОВ ВЕДЕНИЯ ДИСКУССИИ НА ЗАНЯТИЯХ ПО АНГЛИЙСКОМУ ЯЗЫКУ В ВОЕННОМ ВУЗЕ

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Модернизация образовательной системы Российской Федерации подразумевает необходимость расширения спектра базовых умений и навыков, формируемых у обучающихся. В эпоху глобализации, наряду с профессиональными знаниями, навыками и умениями, ценятся коммуникативные способности, необходимые для межличностного и межкультурного сотрудничества как внутри своей страны, так и на международном уровне [1, с. 11]. Способность корректно и эффективно формулировать собственную точку зрения по спорной теме, признавать чужое мнение по теме, формулировать суждение и умозаключение, строить доказательства с использованием разнообразных аргументов являются неотъемлемой характеристикой современных специалистов-профессионалов.

Будущие специалисты по роду своей профессиональной деятельности должны быть способны продемонстрировать такие умения и навыки профессионального общения, как построение аргументированной монологической речи, так и ведение аргументированной дискуссии на иностранном языке. Обучение ведению дискуссии является одним из важных аспектов коммуникативного подхода в обучении иностранному языку.

Метод дискуссий как один из методов проблемного обучения находит все большее применение на занятиях по иностранному языку. Владеть навыками ведения дискуссии предполагает «уметь без подготовки, достаточно бегло, точно и эффективно говорить на общие профессиональные темы, четко обозначая взаимосвязанность идей, используя необходимую лексику и терминологию и практически не допуская грамматических ошибок; уметь высказать личное мнение и подкрепить его аргументами, в том числе для опровержения других мнений, а также высказать и обосновать гипотезу; уметь в диалог или дискуссию, а также