

Рис. 7 – Проверка введенных данных

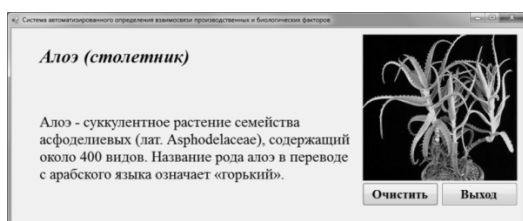


Рис. 8 – Вывод первого результата на экран

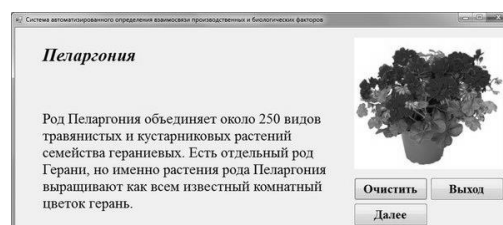


Рис. 9 – Вывод второго результата на экран

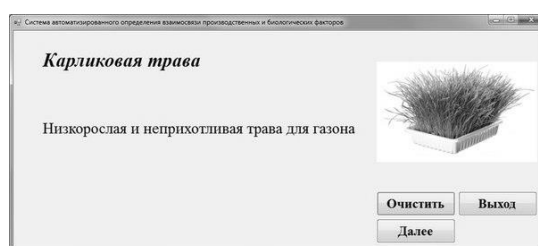


Рис. 10 – Вывод третьего результата на экран

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#### Methods having influence on combustion in the mode of self-propagating high-temperature synthesis

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One of the actual problems of nuclear energetics is to search new materials meeting strict requirements of environment and radiation security.

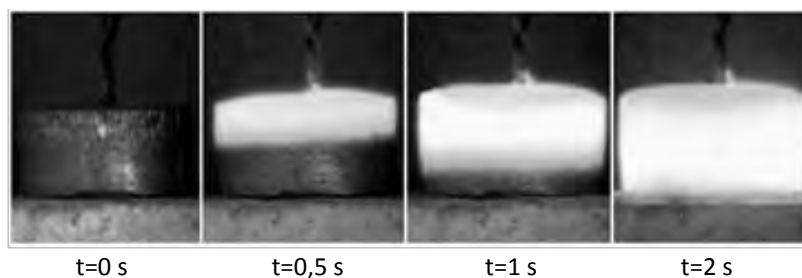
In 1967 the group of scientists under the direction of Merzhanov A.G. from the Institute of Chemical Physics of the Academy of Sciences of the USSR managed to discover a new technique of substance synthesis.

Self-propagating high-temperature synthesis (SHS) is an exothermic reaction initiated locally as a result of what chemical transformations move in mixture in the mode of combustion wave (self-propagation) with the formation of solid products. The feature of such reaction is a practically full absence of gas emission and high heat emission during chemical interaction [1].

The combustion process in SHS has a controllable character, realized in three stages: [2]:

- preparation of burden components;
- carrying out of SHS;
- cooling of finished products.

The preparation stage is regarded as the most technological where burden parameters can be changed. So, the possibility to impact on synthesized materials is appeared. The methods having influence on initial parameters: mechanical activation and compacting pressure [2].



**Figure 1.** The reaction of self-propagating high-temperature synthesis

Mechanical activation is a formation of substance with higher chemical activity owing to preliminary mechanical processing. The energy acquired during activation time is assimilated by solid in the form of point and line defects [3]. The accumulated dump energy is released during the synthesis. In addition, during mechanical activation a particle size is decreased what increases contact area. The process of mechanical activation can be observed in devices capable of grinding in impact, impact-rubbing or rubbing modes (the VSI, planetary and jet mills and other apparatus where high values of frequency and force of mechanical impact are combined). Compared with other apparatus planetary mills have higher efficiency. As a result of its use the maximum accumulation of structure defects is observed, the curvature value of surface is increased [1, 2].



**Figure 2.** Planetary ball mill AGO-2S

As a result of mechanical activation of reagents the decrease of initial particle size and the increase of reactivity of solid reagents are observed; the temperature of reaction initiation is reduced; the structure is become more uniform; the mechanical properties of materials are improved (the porosity is reduced, the strength is risen, the plastic properties are improved).

Compacting pressure of initial components is one of the factors impacting on the obtaining of finished SHS products. A pressing allows destroying the structure of initial burden, at that a plastic deformation and particle diffusion are observed. When the compacting pressure of reagent mixture is increased its density is also being increased till concrete moment of time.

During the increase of compacting pressure and, consequently, of density a contact between initial reagents is increased. It allows to lower energy expenditures on reaction initialization decreasing the temperature of initialization as well as to increase the speed of combustion and heat-transfer from hot product to cold one. The low temperature of synthesis initialization diminishes thermodynamic destructions. Without any doubt it is a great advantage in the creation process of new materials.

If the density of mixture is too high it will have negative influence on synthesis. The reduction of combustion speed will be observed because the drastic increase of heat extraction from reaction zone to initial reaction mixture will be occurred. As practice shows samples with high density value (90% of theoretical and higher) usually cannot be burnt or combustion in such mixtures decays. [4].



Figure 3. Hydraulic press PLG-12

There are a lot of methods having influence on passing and controlling of SHS. The most technological and widespread methods are realized on the stage of preparation of burden parameters (mechanical activation and compacting pressure). The main features of other methods having influence on synthesis are studied. At the use of impact factors the influence on phase states is observed. It means that physicochemical properties of materials are changed. At the use of these factors the possibility not only to control the synthesis but also to obtain an object with required properties is appeared.

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#### Экологические проблемы металлургической промышленности как энергоемкого производства

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Экологический вред, причиняемый промышленностью, в первую очередь - это выбросы углекислого газа, образующего в последствии парниковый эффект и глобальное потепление планеты. Развитие металлургии и химическая и нефтехимическая промышленности в основном являются глобальными загрязнителями воздуха, атмосферы. Тепловая электростанция и химическая промышленность являются и загрязнителями воды. Атомная энергетика, металлургия, развитие химической промышленности преимущественно повреждают плодородный слой земли, почвы. Металлургия сильно воздействует на все или большинство компонентов окружающей среды.