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Opinion

Opportunities for the Modernization of Energy-Intensive Chemical Technologies Based on the Use of Accelerated Electrons.

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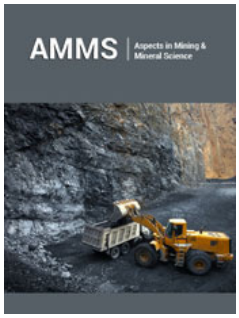

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Analysis of traditional technologies for the decomposition of complex substances shows that improving their efficiency faces a number of fundamental difficulties. These include: the combustion of non-renewable natural fuel, low efficiency of the thermal process, environmental problems, impurities in the resulting products, large metal consumption for furnacesconstraction, extensive and costly infrastructure, waste disposal costs, a significant proportion of unskilled labor, etc. [1]. Urgent modernization of these technologies, based on new principles and approaches, is needed. In our opinion, it should be just the replacement of old energy carriers for the new ones. Such a new source of energy appears as a beam of accelerated electrons. Relatively low-power electron accelerators are already used for practical purposes. However, their wide application in the large-scale industry (cement production, etc.) seems exotic at first glance.

The electron accelerators created at the Institute of nuclear physics. G. I. Budker SB RAS seems to be the most appropriate for application. These accelerators cover the energy range from 0.2 to 2.5MeV. The accelerators are simple in design, provide long-term operation in a real production conditions, have high efficiency, are fully automated and radiation-safe [2-3]. Similar accelerators are developed and manufactured in other countries.

The need for the introduction of an alternative modernized technology is due to the requirements of increasing the efficiency of energy transfer to the processed raw materials and significantly reducing the environmental burden. The interest in this direction of technology development is caused by the fact that various activation processes in solids and liquids occur more intensively under the influence of electromagnetic radiation due to radiation excitation during relaxation of metastable states, formation of defects, amplification of vibrational excitations due to interaction of the incoming electrons with atoms and molecules. This occurs not only due to the direct action of radiation, but also due to the interaction with the irradiated substance of the radiolysis products of aqueous solutions and melts.

In more detail physical and technical bases, advantages of radiation technology and possible technological decisions are stated in work [4]. Here is only a basic, from our point of view, the assessment of energy costs for the decomposition of calcium carbonate by alternative technology. They are on the new technology is 2MJ for the decomposition of 1kg, while the traditional–about 5.3MJ. In work [5] the approach to modernization of production of aluminum on the basis of application of an electron beam in the technological scheme is offered. The reasons, prospects of this approach, features of the impact of accelerated electrons on chemical reactions in liquid and solid materials used in the aluminum industry are discussed. The analysis is given of the energy balance for the classical method of aluminum production and the conclusion about the feasibility of modernization of aluminum production technology based on a new energy carrier. The reasons for the success of modernization on the basis of the new approach are the equality of technical energy consumption of classical and new technologies. Today, this equality is already being observed.

In conclusion, we note that the study of physical and chemical bases of intensification of chemical reactions in such processes as leaching of ores, dehydrogenation and sintering

is the main task at the present, initial stage of development of radiation technology for the production of soda, aluminum and other important products. Commercial availability of relatively low-power electron accelerators provides opportunities already at the present time with small financial investments to start work on the formation of the technical basis for the modernization of traditional aluminum production technology, other important products without prematurely be involved in the experiments on powerful and expensive industrial accelerators. The present time is requesting the new approaches to the real problem solving. The electron accelerator is no longer an exotic toy, but a real tool of the progress in chemical industry production.

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