

Using Tagged Neutron Method for On-line Analysis of Materials on Conveyor

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This paper discusses the application of the AGP-K conveyor analyzer to solve the problem of controlling the elemental composition of material on the conveyor. The result of the analyzer operation is given and the obtained data are discussed.

The results of using tagged neutron method for on-line analysis of materials on conveyor are presented. The method of tagged neutrons makes it possible to determine the concentrations of the desired elements inside objects contactless, due to the large penetrating power of neutrons.

The Tagged Neutron Method consists in irradiating the object of analysis with beams of fast neutrons with an energy of 14,1 MeV, which are formed in the reaction $d + 3H \rightarrow 4He + n$. [1-3] In this reaction, the neutron and the α -particle fly apart in almost opposite directions. Therefore, by registering the α -particle accompanying the neutron, it is possible to determine the direction of neutron departure. This procedure is called tagging of neutron. A fast neutron with an energy of 14,1 MeV enters the substance of the object and interacts with the nuclei of the substance in inelastic scattering reactions ($n, n'\gamma$). Since each chemical element has its own characteristic gamma spectrum, it is possible to conduct an elemental analysis of the object under study.

Irradiation of the material on the conveyor occurs by a beam of fast tagged neutrons with an energy of 14 MeV from the ING-27 portable neutron generator manufactured by NL Dukhov All-Russian Scientific Research Institute of Automation (VNIIA), gamma quanta from inelastic scattering reactions are recorded by a system of 14 scintillation detectors based on a BGO crystal. Tagged neutron is carried out by registration of α -particles formed in the reaction $d+3H \rightarrow 4He+n$, which makes it possible to reduce the influence of the background by 200 times. The analyzer also includes power systems, data collection systems and biological protection.

The analyzer provides data on the elemental composition of material on the conveyor every 40-60 seconds. The results of the analyzer operation for control of sinter are discussed.

1. V. Valkovic, «14 MeV Neutrons: Physics and Applications», Taylor & Francis Group, 2016, 516 p.
2. Alexakhin V.Y. et al., «Detection of Diamonds in Kimberlite by the Tagged Neutron Method.», Nuclear Instruments and Methods" A785, 2015, 9 p.
3. V.M. Bystritsky et al., «Physics of Particles and Nuclei Letters», 2008, Volume 5, p.441.

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Section

1. Applications of nuclear methods in science and technology

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