PROMPT NUCLEAR ANALYSIS WITH USE OF NEUTRON SOURCES

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Abstract

In Prompt Nuclear Analysis (PNA) the testing is performed by the registration of particles or quantum produced via nuclear reactions or atomic collisions of any kind: particles. In this case the penetrating particles suffer elastic or inelastic scattering, excite nuclear reactions producing neutron, charged particle ore gamma-rays emitted due to radiation capture etc. Methods are mainly used with low energy accelerators of charged particles ore ampoule sources of neutrons (for example, neutron generator and ^{252}Cf). Some kinds of PNA in addition to the determination of overall impurity provide means to determine the chemical element amounts in specimen's depth, the impurity location in a crystal lattice and the thickness of deposited oxide/others layers..

Because of their lack of charge, neutrons have a mean free path of the order of centimeters or greater in most materials. They are therefore ideally suited to the non-destructive analysis of bulk material. The complexity of the radiation produced by reactions with heave nuclei has meant that most applications have been restricted to the study of light and medium weight nuclides. In these mass regions it is often desirable to use higher energy neutrons such as are produced by small accelerators

In our laboratory the research is spent with the purpose of application of neutron sources for the analysis of a grain and its products. We do attempt to determine the contents of nitrogen with application of both nuclear methods - Delayed Nuclear Analysis (activation Analysis Technique), and PNA. In last case for determination of the protein contents in the investigated samples the gamma-rays formed during course of nuclear reactions are detected. Neutrons do not lose energy by ionization as they travel through a sample, but because of the relatively high nuclear cross sections, attenuation of the neutron beam intensity can be quite appreciable

In all but the light nuclides, a great many γ- rays are emitted with energies up to the neutron binding energy for each nuclide. A high sensitivity factor is not sufficient to insure easy detection of a particular gamma ray since it is also necessary to be able to distinguish this γ - ray from others with similar energies.

Our tests have used NaI detectors, sometimes because of interest in compact systems for special research connected with analysis of protein. These detectors have inadequate energy resolution so that spectral contrast factors are always poor. Apparently, in subsequent in our experiments we shall use the spectrometry with the high energy resolution.