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Neutron Activation Installments for Control of Flour Spar Enriching Factory in Mongolia

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Mongolia is rich in fluorite resources and enriched fluorine is one of items of mineral export of Mongolia. Sorting fluorite ore on the input of the enriching factory is an important measure to keep the enrichment process running smoothly. A determination of fluorine content in the enriching pulp allows fast control of the enriching process. Rapid neutron activation technique for fluorine content determination in the pulp takes 15 min against the traditional chemical analysis (one day).

In this paper, devices based on neutron activation technique for fluorine determination in fluorite ore and enriching pulp in the factory are described. The first device (Fluorite-1) was developed as a stationary instrument for fluorine content determination in the fluorite ore at mine. The second device (Fluorite-2) was developed to determine fluorine content in ore on the lorry to sort ores in the factory input. Sorting ore on arrival by its content is important for enriching process control, as ore to the factory arrives from different mines. The third device (Fluorite 1M) was developed as stationary (like Fluorite-1) to determine fluorine content in the enriching pulp to control a enriching process.

All devices use fast neutron activation analysis. Neutron sources ^{238}Pu -Be, ^{241}Am -Be, ^{252}Cf were used for nuclear reaction $^{19}\text{F}(n, \alpha)^{16}\text{N}$ with measurements based on detecting the resulting 6.13 MeV γ -ray. Coincident γ -ray of 5.5 MeV and 5.11 MeV are detected which are released from the samples during the measurement. The ^{16}N half-life is 7.35 s and the γ -ray intensity is proportional to the fluorine content (CaF_2) in the ore or enriching pulp. Fluorine content is calculated compared with standard samples. Regular 150×100 mm NaI(Tl) γ -ray detectors collect the data.

Fluorite-1 is single channel spectrometry system, where samples and standards are measured in turn using one counter system. Fluorite-2 is a microprocessor controlled system. Neutron activation of the ore and γ -ray detection is made by a pneumatic system moving source and detector to the lorry. Spectrometry amplifier stabilizer was developed as the detector of device placed outside and amplitude of detector signal was changing depending on temperature change (temperature range is -40°C to $+40^\circ\text{C}$). Standard ^{137}Cs sources were used for stabilization, calibration and control of the measuring system. Fluorite-1M has two

counters to count pulses from standard and the samples in each counter, which allow to reduce time of measurement.

Fluorite 1M had absolute error less than 1% and it was much needed for Bor-Undur, Fluorite Enriching Factory, Mongolia during the economic crisis years 1990–2000, when there were shortage of chemical components for chemical analysis of the factory. This kind of device can be used for control of fluorine enriching factory for industry process control. Especially this kind of device is needed for purchasing of fluorite ore from individual customers or export in Mongolia.

Country/Organization invited to participate

Mongolia

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