and lays a solid foundation for the good performance of the silicon strip detector.

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5 - 12 Progress on Portable Rapid Detection Device for Measuring Content of ^{40}K, ^{238}U and ^{232}Th in Minerals

Shi Guozhu, Li Songlin, Cheng Hongsheng, Chen Ruofu
Li Hengyuan and Shen Aihua

A portable rapid detection device with four isolated single-channels which is used to measure the γ spectra of ^{40}K, ^{238}U and ^{232}Th in minerals has developed by the crystal detector group of IMP at present. Each channel in the device is mainly composed of four parts, such as the radiation detector with CsI(TI) crystal, the high quantum efficient PMT, the subsequent electronics and the counter. The specific nuclide will be identified by measuring its corresponding characteristic γ ray. The window with suitable ULD(Upper limit discriminator) and LLD(Lower limit discriminator) are chosen for a single channel of the device through PC control software (or hardware) to measure the full-energy peak counts of the characteristic γ ray. ^{40}K, one of the three natural potassium isotopes with an enrichment of 0.012%, can be identified by tracing its decaying γ-ray of 1.461 MeV from ^{40}K to ^{40}Ar. As for ^{232}Th and ^{238}U in minerals, the decay chains from thorium series or uranium series have kept in long-term equilibrium, and the γ rays of 2.615 MeV from ^{208}Tl decay and 1.764 MeV from ^{214}Bi decay could be used as the characteristic γ lines for the tracing of their parent nuclides ^{232}Th and ^{238}U respectively.

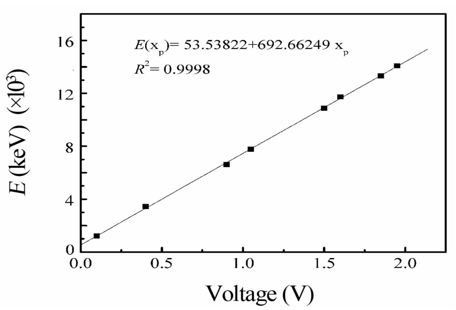

Fig. 1 Linear fitting between the γ ray energy and the threshold voltage.

Calibration has been carried out with the standard γ rays of ^{137}Cs, ^{60}Co, ^{152}Eu and ^{207}Bi source. Keeping the window between LLD and ULD fixed as 0.1 V, we increased the LLD threshold step by step from 0.05 to 3.0 V, and the energy spectra were thus derived. Each γ-ray full-energy peak is uniquely designated to a threshold voltage. The relationship between the standard γ ray energies and their corresponding threshold voltages were plotted in Fig. 1, which is in good linearity. From the interpolation or extrapolation from Fig. 1, we deduced that the central threshold voltage level for ^{40}K, ^{238}U, ^{232}Th were 2.03 V, 2.47 V and 3.69 V respectively for the specific γ rays of 1460.8, 1764.4 and 2614.5 keV. A standard potassium sample has been tested by the detection device, and the threshold voltage corresponding to the γ ray of 1460.8 keV from ^{40}K decay, was just consistent with the derived value of 2.03 V.

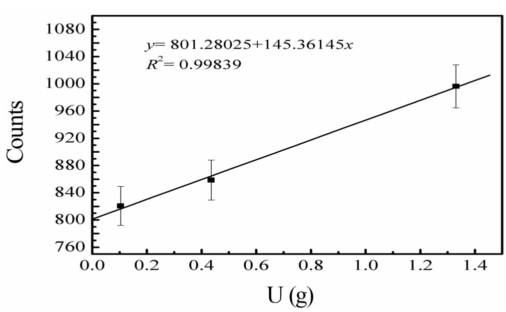

Fig. 2 The count of standard uranium samples vs the weight of ^{238}U content.

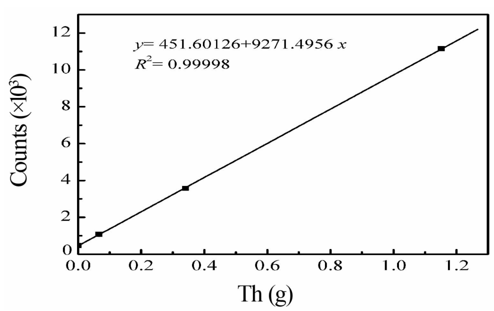

Fig. 3 The count of standard thorium samples vs the weight of ^{232}Th content.

The LLD and ULD for the uranium standard samples were finally set as 2. 2 and 2. 6 V respectively to eliminate the interferences from ^{40}K and ^{232}Th. The relationship between the count of standard ^{238}U samples and the weight of ^{238}U content in the samples was shown in Fig. 2, which were in good agreement in the error range. As for standard ^{232}Th samples, the threshold values were set as 2. 8～3. 8 V, and the results were shown in Fig. 3. It's shown that the weight of ^{232}Th content and the counts of standard samples is in a good linear relationship within statistical errors.

The portable rapid detection device has four individual channels, which could measure the background, ^{40}K, ^{238}U and ^{232}Th at the same time. It's the second generation of our potassium-measuring device, which has single channel only, and works in the same mode. We will further optimize the measuring conditions of ^{238}U and ^{232}Th samples in the future for the development of the four-channel detection device.

5 - 13 Nuclear Data Measurement Facility for ADS Spallation Target Design

Chen Zhiqiang, Liu Jianli, Han Rui, Shi Fudong, Zhang Suyalatu, Liu Xingquan
Jin Zengxue, Lin Weiping and Roy Wada

The nuclear data measurement facility for ADS spallation target design has been preliminarily constructed, which provides a very important platform for the experimental measurements of spallation reactions. The facility consists of a high vacuum thin metal foil ion beam window, a remote controlled moving target system, a beam pickup time-of-flight detection system, a light charged particles time-of-flight spectrometer, a neutron time-of-flight spectrometer, a radiation protection system and electronics and data acquisition system. The high vacuum thin metal foil beam window is equipped with a gate valve, a vacuum chamber, a mechanical pump, a molecular pump, a vacuum measurement system and a metal foil ion beam window. The remote controlled moving target system includes a stepper motor controller that controls an operation of a stepper motor to move target frame in the beam position by a 4 0 m long cable . The beam

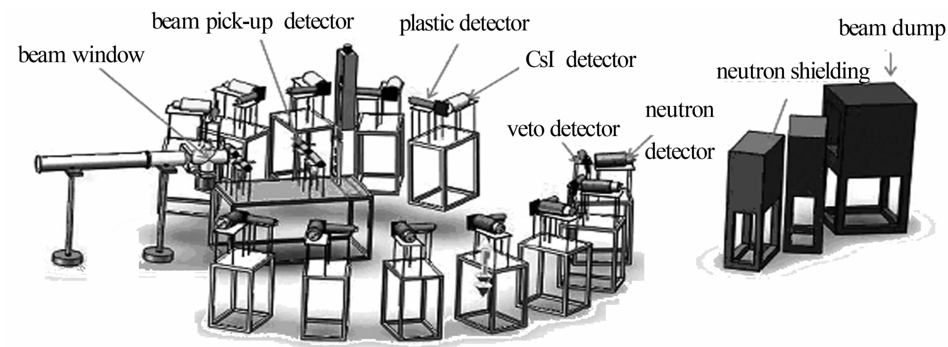

Fig. 1

pickup time-of-flight detection system includes a plastic scintillator detector with dual-PMT readout, which can give the time and position information of the beam and two plastic scintillator detectors with single-PMT readout, which can limit the size of the beam profile. The light charged particles time-of-fight spectrometer consists of a plastic scintillator detector and CsI(Tl) detector. The plastic scintillator detector is used to measure the TOF and energy loss of the particles and the remaining energy of the particles is collected in the CsI(Tl) detector. The light charged particles can be identified with TOF-d*E*-*E* technique. The neutron time-of-flight spectrometer consists of a plastic scintillator detector and a liquid scintillation detector. The energy spectrum of the neutron can be obtained by time-of-fight method. The plastic scintillator detector is used to veto the charged particle in the neutron detector. The liquid scintillation neutron detector can be used to measure the quick timing information and excellent neutron-gamma discrimination capability. The radiation protection system includes beam dump and neutron shielding wall. The beam dump is used to stop the beam so that it can prevent the radiation pollution since the high energy beam pas-