AN AUTOMATED ACTIVATION ANALYSIS DATA ACQUISITION SYSTEM

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An automated neutron activation analysis data acquisition system has been assembled from commercially available equipment. The modifications of the components needed to make this into a working system are described in the text. The main components of the data acquisition system are a sample changer, a Ge(Li) detector, a magnetic tape deck and a minicomputer based multichannel analyzer. The sample changer has a 200-sample capacity and can handle both solid and liquid samples. Software for controlling the data acquisition system is flexible, yet simple to use. The system has operated reliably for a year and has sharply reduced the effort needed for data acquisition.

Introduction

Much of the effort in instrumental activation analysis is spent in two operations: (1) acquiring and storing spectra from irradiated samples and (2) analyzing these spectra to ascertain which elements are present and at what concentration. Automation of data acquisition and reduction procedures is almost a necessity in experiments involving large numbers of analyses, such as biological or environmental studies.

Since some of the samples may be liquids, an automatic data acquisition system must be able to handle both liquid and solid samples. A survey of commercially available equipment failed to reveal a single sample changer design which would (1) accept a Ge(Li) detector, (2) be able to handle both liquid and solid samples, (3) include built-in safeguards against contaminating a Ge(Li) detector, and (4) operate reliably. MASSONI et al.\textsuperscript{1} have described a sample changer designed to be used with a Ge(Li) detector which was capable of low level counting. However, it had only an 18-sample capacity and was not specifically designed to be used with liquid samples.
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This paper describes how a useful, time-conserving automated data acquisition system that combines all of these properties was assembled from commercially available equipment (with only slight modifications). The computer reduction of the data has been briefly described elsewhere and will not be repeated here.

System description

The system consists of a modified Nuclear Chicago Model 1185 sample changer, a Ge(Li) detector and electronics, a Nuclear Data 4410 computer-based multichannel analyzer with auxiliary equipment and a PEC magnetic tape unit.

Sample changer

Front and back views of the Nuclear Chicago sample changer are shown in Fig. 1. Since the changer was designed for use with a NaI(Tl) detector it had to be modified to accept the larger volume required by the Ge(Li) detector and its Dewar flask. The modification involved separating the changing mechanism from the cabinet and inserting a piece of sheet metal as shown in Fig. 1. A shelf was installed (back view) to support the lead shielding. The Dewar flask for the Ge(Li) detector sits on a platform on wheels and the changer itself is on wheels; thus both the detector and the changer can be moved as a unit when the detector is secured in place. A large laboratory jack is built into the platform on which the detector sits to enable the detector to be raised into the cylindrical hole of the lead shielding. This arrangement makes it possible to vary the distance between source and detector and to change detectors easily so that the most appropriate detector for a particular analysis may be used.

The sample changing mechanism consists essentially of an elevator, a sample sensing switch and a closed chain in which each link holds one sample. The chain moves forward until the sensing mechanism determines that a sample is over the elevator shaft; then the elevator lowers the sample. When the sample is positioned properly, a signal (value of DC voltage level) is relayed to the analyzer to start analysis of the new sample. Upon completion, the elevator lifts the sample, the chain moves forward until a new sample is over the elevator shaft, and the elevator then lowers the new sample to the detector.

The changer has a 200-sample capacity and can accept different size and style vials with volumes up to 20 ml. Thus liquid samples up to 20 ml can be counted directly; to count samples of larger volume, an aliquot can be taken. The samples are neither shaken nor tipped nor do they undergo any violent action during the changing operation. Thus the system is well suited for counting radionuclides either