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Neutron Activation Analysis and its Application in Malaysian Nuclear Agency

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Abstract

In Malaysia, the research reactor is utilized for various applications including neutron activation analysis (NAA) for research and service purposes. Throughout the years, many research projects have been successfully conducted at the NAA laboratory through international and local collaborations. These collaborations had been very important to improve on the research and applications of NAA in the country. The applications of NAA in the Malaysian Nuclear Agency are discussed in this paper.

Introduction

Neutron activation analysis (NAA) is a non-destructive method with multi-elemental capability. The NAA technique provides high sensitivity and accuracy for trace element determination that could be applied to analysis of various sample types namely geological, biological and environmental samples. Simple sample preparation steps in NAA prevent sample contamination and only small sample size (about 100-500 mg) is required. Neutron source from a research reactor is required to perform NAA either for short and long time irradiation. In Malaysia, the PUSPATI TRIGA MARK II research reactor provides neutron irradiation facilities for NAA application. After activation by neutron, gamma-rays emitted from radionuclide were measured using HPGe detectors and spectra were analyzed using appropriate software. Quantifications of elemental concentrations are commonly performed using comparative method. Utilization of NAA is quite encouraging and many research projects were completed and new projects are being conducted. This paper will discuss the applications of NAA in Malaysian Nuclear Agency.

The PUSPATI TRIGA MARK II reactor

The Malaysian Nuclear Agency (Nuclear Malaysia) owns the only research reactor namely the PUSPATI TRIGA MARK II reactor which comes into operation in 1982. The PUSPATI TRIGA MARK II reactor is a 1MW light-water moderated pool-type reactor. The first criticality was achieved on 28 June 1982. The cross section of the reactor is shown in Fig. 1. This research reactor is equipped with four beamports and one thermal column as shown in Fig. 2. Nuclear fuels of this reactor are standard TRIGA fuel elements (112 rods) composed of zirconium hydride alloy containing enriched uranium (8.5 – 20 wt.%) and cladded with stainless steel. The fuel elements configuration is shown in Fig. 3. During routine operation, the thermal neutron flux at rotary rack (RR) and pneumatic transfer system (PTS) is about 2.3 x 10^{12} n/cm^2/s and 5.4 x

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