Contribution ID: **222** Type: **Poster**

Instrumental photon activation analysis with the MT-25 microtron

Monday, 12 May 2014 17:15 (1h 30m)

Instrumental photon activation analysis (IPAA) is a useful and complementary method to instrumental neutron activation analysis (INAA). IPAA allows determination of number of elements not determinable by INAA, and determination of many elements with a better sensitivity than INAA. Unlike INAA based mainly on the neutron capture reactions (n,gamma), PAA is based on photonuclear reactions, particularly photodisintegration reactions (gamma, n) and (gamma,p), and photoexcitation reactions (gamma,gamma'). These reactions take place only at photon energies exceeding a threshold. This can be utilized in optimizing beam energy at irradiation of a specific sample, when partial suppression of interfering nuclear reactions can be achieved by keeping the maximum photon energy below or only slightly above their threshold. Particularly in analysis of geological samples (minerals and rocks), this reduces substantially, compared to INAA, matrix effects hindering determination of trace elements. Higher penetration of high energy photons and lower activities produced allow also analysis of larger samples.
An effective source of the high energy photon radiation for use in IPAA is the secondary radiation - bremsstrahlung - produced at deceleration of electrons accelerated in a high frequency cyclic accelerator - microtron. The MT-25 microtron built at the Czech Technical University in Prague in the late 1980s, after its takeover and modernization by the Nuclear Physics Institute ASCR in the years 2003-2005, has been utilized regularly for purposes of IPAA. Until recently, IPAA analyses could be carried out only in an offline regime, i.e., in assay of elements providing by photoactivation radionuclides with half-lives long enough for counting with a sufficient count yield even after decay time elapsed between switching off the microtron and manual delivery of sample to a detector. Currently, installation of an automated pneumatic system for rapid sample transport between the beam position and detector in an online regime is being completed which will, regarding numerous short-lived products of photonuclear reactions, provide substantial extension of the analytical range of IPAA. The contribution presents possibilities and recently realized examples of utilization of IPAA with the MT-25 microtron, namely a recently developed and optimized procedures for fast fluorine and nitrogen assay, and their application in analysis of various materials.

The work has been supported by the projects 13-27885S and P108/12/G108 of the Czech Science Foundation.

Primary author: Mrs KRAUSOVÁ, I. (Nuclear Physics Institute ASCR)

Co-authors: Mrs CHVÁTIL, D. (Nuclear Physics Institute ASCR); Dr MIZERA, J. (Nuclear Physics Institute ASCR); Dr KRIST, P. (Nuclear Physics Institute ASCR); Dr ŘANDA, Z. (Nuclear Physics Institute ASCR)

Presenter: Mrs KRAUSOVÁ, I. (Nuclear Physics Institute ASCR)

Session Classification: Poster Session - Nuclear Analytical Methods

Track Classification: Nuclear Analytical Methods