RADIOCHEMICAL DETERMINATION OF NUCLEAR DATA FOR APPLICATIONS

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Nuclear data find applications in many fields, their major significance being in nuclear technology and nuclear medicine. Both radioactive decay and nuclear reaction cross section data are needed. In nuclear technology the decay data are important mainly for calculation of decay heat and the reaction cross section data for estimation of radiation damage, neutron transport and total radioactivity, including actinides, fission products and activated reactor components. In nuclear medicine the decay data are needed for estimating radiation dose caused to the patient, and the reaction cross sections for optimisation of production routes of radionuclides.

Nuclear data measurements demand use of interdisciplinary techniques, e.g. identification of emitted particles via spectral methods, quantitative characterisation of radioactive products, mass spectrometry (MS), accelerator mass spectrometry (AMS), etc. In many cases use of radiochemical separation and/or mass separation is absolutely necessary. About 40 years ago a large number of measurements were done radiochemically (e.g. fission products). With the availability of high-resolution detectors the role of radiochemical methods has undergone a tremendous change. Today radiochemical methods are selectively applied, for example when low-yield reaction products in a strong matrix activity or soft radiation emitting radionuclides are under investigation. In the former case the aim is to decrease the disturbing background, and in the latter to decrease the self-absorption of the radiation in the sample itself. The latter application is particularly useful when X-ray emitters or when decay of low-level isomeric states are involved. A few examples will be discussed where the radiochemical methods are found to be superior to the commonly used physical methods. In fission reactor technology and nuclear transmutation studies fast neutron data up to 20 MeV are needed. Many of them can be advantageously measured via the radiochemical technique. Similarly in cyclotron production of medical radionuclides, the radiochemically obtained nuclear data are of paramount importance in assuring the radionuclidic purity of the product. Some typical cases will be discussed.