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OPENING LECTURE - Prompt Gamma Activation Analysis using High-Flux Cold Neutron Beam

Thursday, 20 September 2012 08:00 (20 minutes)

The Forschungsneutronenquelle Heinz Maier-Leibnitz at Garching (FRM II) is one of the largest neutron research centers in the world with almost 30 high-end instruments. The Prompt Gamma Activation Analysis (PGAA) facility is located at the cold neutron beam with a flux of 6 x 10ˆ10 cm-2 s-1, the highest beam flux reported. The instrument has been reconstructed recently to enable elemental analyses and irradiations with this strong beam, too. High-flux PGAA made possible new applications, but also introduced brand new challenges, which are discussed in the presentation.

The contribution of the background in the prompt gamma spectrum reduced significantly thanks to reconstruction of the shielding of the instrument. The excellent signal-to-background ratio allows the measurement of samples with the masses of less than a milligram, which is practically impossible in weaker beams. For this purpose, it was necessary to find significantly lighter materials for sample packing. The reconstruction of the sample holder from less massive components is also planned to further reduce the spectral background. The use of smaller target quantities also makes possible the efficient measurement of radioactive materials and the counting of their signals above the elevated baseline from to the original activity.

The new PGAA instrument has been used for high-flux irradiations and elemental analyses of a series of different samples successfully. Air filters with pollution contents as low as a milligram or less were analyzed, and more than 10 components were determined with fair uncertainties. The most sensitive elements (B and certain rare-earths) were found to be in amounts of less than 100 pg. The elemental compositions of micrometeorites with masses of 300–1000 □g were determined, and they were classified based on the results. In the frame of a large international collaboration, nuclear data for transuranium actinides have been remeasured. The plans of further improvements and other possible utilizations of the high-flux PGAA facility will also be discussed.

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