Neutron Activation Analysis Encyclopedia Article

Neutron Activation Analysis

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Neutron Activation Analysis

Neutron activation analysis is an analytical technique for determining the elements present in a material as well as the amount of each element in the sample. The technique is based on a well-known reaction from nuclear **chemistry**. When an element is bombarded with neutrons, some of the atoms of that element may capture neutrons and incorporate them into their nuclei. Those atoms that do so have the same atomic number (that is, are the same element) as the original target element, but have an atomic **mass** of one higher. Bombarding atoms of sodium-23 with neutrons, for example, converts them to atoms of sodium-24.

In most cases, the heavier atoms formed in this reaction are radioactive. They usually decay with the emission of a beta particle and a **gamma ray**. The **energy** associated with these decay schemes is characteristic of the radioactive **isotope** in question. For example, a gamma ray released in the decay of sodium-24 has an energy of 2.75 or 1.37 MeV.

In practice, nuclear activation analysis is carried out by placing thesample to be examined in a nuclear reactor. The neutrons available in the reactor bring about the n/c (neutron/gamma ray) reactions described above. The radioactive sample is then removed from the reactor and examined with a gamma ray spectrometer. This device measures the type and intensity of **radiation** released by the sample. These data can then be compared to standard tables to determine which elements and the amounts of each are present in the sample.

Neutron activation analysis is valuable as a non-destructive form of analysis. It can be used without fear of damaging or destroying the material being tested. It is also a very precise form of analysis, permitting the detection of very small quantities of an element. One application that illustrates these strengths is in the analysis of archaeological materials that are too fragile or too valuable to expose to other analytical techniques.