USE OF ACCELERATOR MASS SPECTROMETRY IN RADIOCARBON DATING

E. Hale Göktürk

Department of Chemistry, Faculty of Art and Sciences
Middle East Technical University, 06531- Ankara
ghale@metu.edu.tr

Accelerator mass spectrometry (AMS) is an ultra- sensitive technique for measuring the long-lived radioisotopes like ^{10}Be, ^{14}C, ^{26}Al, ^{36}Cl, and ^{129}I that occur naturally in our environment. AMS uses a particle accelerator, such as those built for research in nuclear physics, in conjunction with magnetic and electrostatic mass analyzers. It employs negative ions, acceleration to MeV energies, and several mass spectrometry stages to eliminate molecular interferences and to separate atomic isobars sufficiently. These characteristics enables AMS systems to be used to measure isotopic ratios of specific elements to a level of 1 in 10^{15}, a factor of 10^5 lower than most MS systems. Moreover, this sensitivity can be achieved for sample sizes of 1 mg or less, within a measurement time of around 1 hour. The radionuclides measured by AMS thus provide new tracing and dating capacities in the geological and planetary sciences, biomedicine and archaeology. Particularly in archaeology, the use of AMS in radiocarbon dating over conventional decay counting has reduced the required sample size from grams to milligrams therefore increase the possibility of dating of individual seeds, aminoacids specific to bones, rare artifacts without undue damage, ice-core samples etc. Purdue Rare Isotope Measurements (PRIME) Laboratory is one of the laboratories applying AMS technique in various radionuclide measurements including radiocarbon. Its AMS facility and some radiocarbon measurements carried using this system will be discussed in order to demonstrate the capabilities of this technique of the last decade.