

PIXE – A Simple yet Powerful Analytical Technique

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The birth of X-ray emission based analytical techniques in 1914, with Moseley relating the frequency of the emission line with the atomic number of the element, heralded the progress of wavelength dispersive X-ray spectrometry. Consequently, rapid progress in the development of the accelerators and the technological breakthrough in X-ray spectroscopy with the entry of high resolution solid state detectors in 1960s paved way for highly reliable atomic and nuclear physics based research. A very versatile nuclear analytical technique, based on the detection of X-rays produced by the interaction of energetic charged particles (usually protons) with the electrons of the atoms in a sample, is Particle Induced X-ray Emission (PIXE). It was first introduced by Johansson et al. at the Lund Institute of Technology in 1970. PIXE is a relatively simple yet powerful ion beam analysis technique that is widely exploited for extracting both qualitative and quantitative information from a specimen. While qualitative analysis of a sample is based on the identification of the atomic species present in the sample from the energies of the characteristic emission lines in the X-ray emission spectrum, quantitative analysis of a given element is based on relating the intensity of these lines to the concentration. Respected for its practical accuracy and detection range of parts per million, PIXE has enjoyed a secure place in the analytical arsenal of the nuclear physics laboratory. PIXE has rapidly gained acceptance as a valuable analytical technique because of the ever-increasing need for elemental analysis of very small amounts of sample. Owing to its numerous capabilities and desirable features, PIXE has found application in the trace elemental analysis of samples from almost every conceivable field of scientific or technical interest like biology, environment, geology, archaeology, materials science, forensic studies and industrial applications.

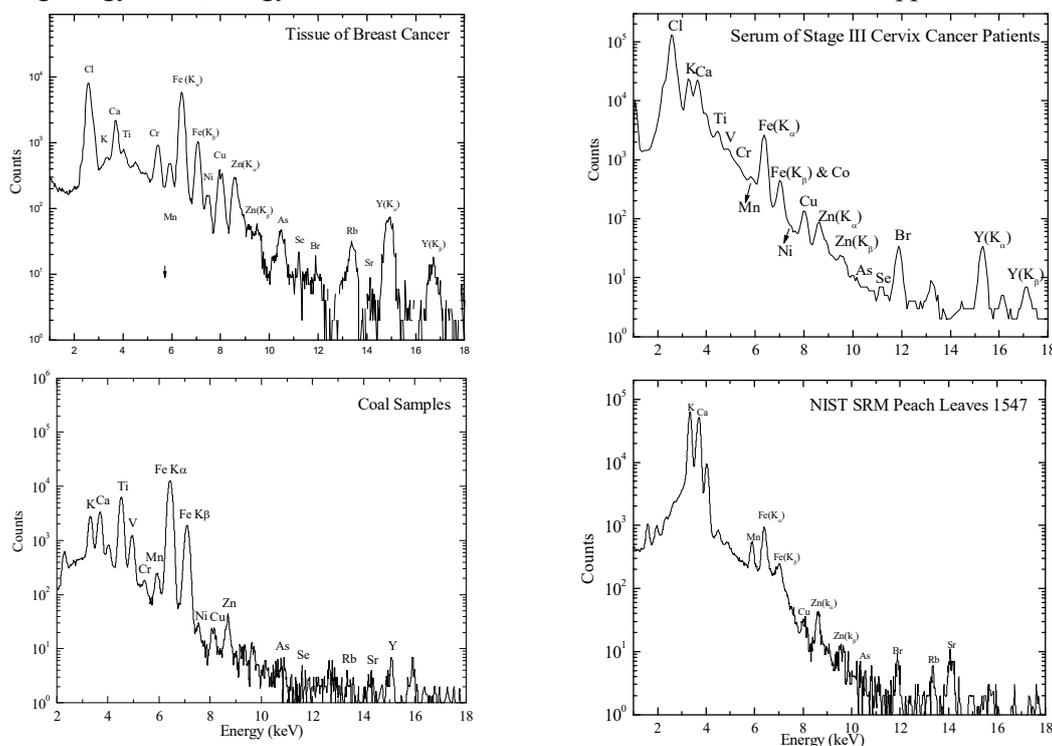


Fig. 1 PIXE spectra of various samples with 3 MeV proton beam bombardment

