



ATICS CORP

CAUTION

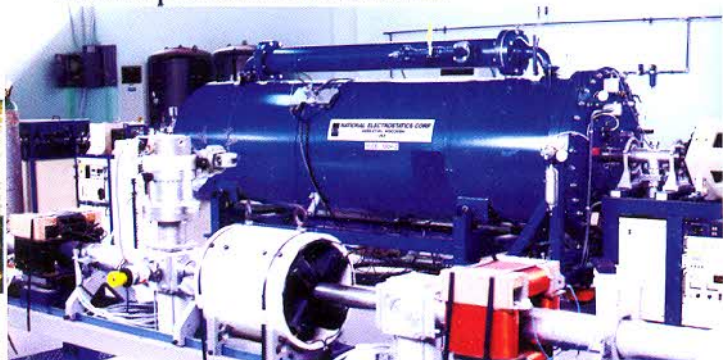
PELLETRON ACCELERATOR FACILITY



**GHANA ATOMIC
ENERGY COMMISSION**

PELLETRON ACCELERATOR FOR ION BEAM MATERIAL ANALYSIS, RESEARCH & TRAINING

Ion beam analysis (IBA) is a group of modern analytical techniques which uses ion beam (accelerated to high energies) onto samples in order to identify and quantify elements in them. It is a non-destructive method as the samples after analysis can be further re-examined by other methods. All IBA methods are highly sensitive and allow the detection of elements at high precisions of about 1 part in a million or less



Ghana Atomic Energy Commission has a Pelletron Accelerator with IBA capabilities installed for purposes of research and training, second of its kind in West Africa.

RBS

Energy of scattered protons or he gives light element component and elemental depth profile

MeV protons
or He

PIXE

Characteristic x-ray emission simultaneous part-per-million detection of trace elements from Na to U

PIGE/NRA

Nuclear reactions give characteristic gamma rays and/or particles from light Nuclear (e.e. U, B, F)

Sample

PARTICLE INDUCED X-RAY EMISSION (PIXE) PRINCIPLES

PIXE uses an ion beam of high energy to determine the elemental composition of samples. Using He^+ or H ion beam to impact a sample produces X-rays which are measured by detectors. The X-ray energies emitted by sample are characteristic of the elements in the sample, thus emitted X-ray spectrum tells which elements are in the sample

Why PIXE?

- It can be used to detect elements in the periodic table from Sodium (Na) to Uranium (U).
- High sensitivity for most elements (ppm)
- Usually requires minimal sample preparation.
- Provides absolute quantification of elements in the sample with no dependence on "reference standards" unlike many other techniques.
- PIXE analysis can be run simultaneously with RBS to provide complementary information, such as "depth profiling" and light-elements analysis.
- It provides a very fast method of analysis and has high accuracy.
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RUTHERFORD BACKSCATTERING (RBS)

RBS uses an ion beam generated at high voltage to determine the elemental composition of samples.

- Incident He^+ or H^+ ion beam is scattered from the sample.
- A detector measures the velocity of the backscattered particles.
- The backscattered velocity is characteristic of the elements in the sample; thus the resultant energy spectrum tells which elements are in the sample.
- A detailed analysis of the energy spectrum tells what element was detected and how deep in the material it was; this allows analyst to build up a depth profile of the elements in the target sample.

Why RBS?

- Depth profiles with 10nm resolution
- Atomic concentration of major and minor elements with high accuracy (<1%)
- Determination of elements in thin films

AREAS OF APPLICATION OF IBA TECHNIQUES

Environmental Research

Ghana as a country is confronted with serious and complex environmental challenges; these challenges include waste management, water and air pollution, illegal mining (which releases toxic and potentially toxic elements such as Mercury, Selenium, Lead, Chromium, Cadmium, Beryllium, Barium, and Arsenic etc. into the ambient environment). This could have serious health implications. Monitoring of our water bodies, air, soil, aquatic habitats for possible contamination to enable us to effectively address health and environmental issues can be achieved through Ion Beam techniques



Industrial and Vehicular emission into the Atmosphere and chemical contamination of water bodies

Plant medicine and Food contamination

Medicinal plants are used in Ghana to treat many human diseases, mainly due to their affordability and minor side effects. Trace-elements associated with these plants might show deficiency or overabundance in terms of concentrations which can affect users positively or negatively



How safe are our vegetable from toxins and elemental contamination by use of inorganix fertilizer



Safety of our Herbal Medicines

Heavy metals (cadmium, mercury and lead) contamination from industries, illegal mining activities, and bad agricultural practices can act as sources of contamination to plants. A test for possible contamination can be done by IBA techniques



Chemical Characterization And Provenance Of Archeological Materials For Education And Tourism



Chemical composition of rock and soil samples

Archaeology and Geological samples

Ghana is very rich in material culture heritage, which needs to be protected, conserved, documented and restored. IBA can be of great assistance in these fields. Chemical characterization of movable cultural heritage objects (pots, figurines, stools, ritual dolls, clothing, carvings etc) can provide scientific facts to support historical facts and to boost tourism.

Forensics

Gunshot residue contains major elements lead, Barium or Antimony which can be easily detected with PIXE. The cartridge case, bullet, bullet coating, and metal jacket also contain specific elements that can be detected. All cartridge cases are made of brass (70% copper and 30% zinc).



Elemental characterization of gun residue and cartridge casing