X-RAY FLUORESCENCE SPECTROMETER (XRF) APPLICATION NOTE

Frequently no preparation whatever is required. In this respect XRF enjoys a distinct advantage over many other methods of elemental analysis. However, it is sometimes necessary to compensate for matrix effects by flushing the sample in borax. This procedure increases the precision and accuracy of the method, but ends up diluting the sample. The following are some typical analytical use of XRF.

**In Agriculture:**
In agriculture the technique is used for the determination of trace elements in plant and foods, the detection of insecticides on fruit and leaves, the continuous determination of phosphorus in fertilizer. The detection in fodder of elements, such as selenium, known to be harmful in large quantities and the characterization of soils.

**In Medicine:**
One of the medical uses of x-ray fluorescence is for the direct determination sulphur in protein. The sulphur content of each of the many different forms in which protein exist in human link for the medical practitioner. Other medical applications include the determination of chloride in that the strontium content of bone and blood serum and bone tissue; it should be remembered that the strontium content of bone and blood is affected by radioactive fallout; and the elemental analysis of tissue, bones, and body fluids.

**In mining and metallurgy:**
In these x-ray fluorescence is used for the analysis of ores, tailings, concentrates, and drilled cores; the continuous determination of silica in flowing slurries of ores; the continuous analysis of zinc in flowing slurries of zinc concentrates; the simple determination of lead in lead-tin alloys; the determination of chromium in stainless steels, manganese in plain steels, and tungsten in high speed steels, the determination of copper, zinc, and tin in copper alloys; the determination of tin or zinc used as coating for steels (such as galvanized steel); the elemental analysis of slag; the classification of alloys; and the direct analysis of platinum and gold in plating solutions.

Other applications include the determination of additives in motor oil by determining barium, zinc, phosphorus, calcium, and chloride, and the determination of lead or sulphur in gasoline. Motor oil is used in automotive, airplane, and train engines, and lubricated bearings in the used motor oil, which results reveal when the motors used in jet aircraft, locomotives, and automobiles are wearing out and in danger of failing. By identifying the mortals that have worn off the motor, it is often possible to identify the actual engine component that is wearing. The latter can then be promptly replaced, thus providing a saving in time and money for the operator and increased safety for passengers.
In rubber industry, the determination of vulcanizing element, sulphur, can be done by x-ray florescence. This is means of ensuring the production of high-quality rubber. In space technology, the analysis of new alloys and ceramics can be carried out x-ray fluorescence.

In all the foregoing determination, the nondestructive nature of x-ray florescence is very important. This feature, coupled with the fact that sample preparation is seldom required, means that direct analysis can be performed in situ. Antiques and art objects can be characterized, and the original and copies of art. In every case the sample is unaffected physically or chemically by the analytical process. This feature is of extreme importance to museums, aircraft manufacturers, and industrialist who use the technique for plant control.

Analytical Uses of X-Ray Fluorescence

XRF is method of elemental analysis. It is most useful for the analysis of metals and nonmetals with atomic number greater than 12. This is a distinct advantage over emission spectrograph with special equipment (an evacuated optical system, light-gathering crystals, and highly sensitive detectors), elements of atomic number 5 through 11 can also be analyzed. The intensity of fluorescence is independent of the chemical state of the elements. For this reason, chemical preparation prior to x-ray fluorescence measurements is frequently unnecessary. The method is nondestructive, an important feature when the sample is available in limited amount or it is valuable or even irreplaceable, as is the case with works of art or antiques.

The florescence spectra are very simple, and overlap of x-ray emission lines from different elements is unlikely; however, background emission from one element may overlap line emission lines from another element.

Qualitative Analysis:
Qualitative analysis can be carried out by measuring the angle of diffraction of the fluorescent x-rays. From this measurement, the wavelength of fluorescence can be calculated. Each element fluoresces at its own characteristic wavelength; hence the fluorescence element can be identified from knowledge of the wavelength of its x-ray fluorescence.
Quantitative Analysis:
Quantitative analysis can be carried out by measuring the intensity of fluorescence at the wavelength characteristic of the element being determined. The method has wide applications to most of the elements in periodic table. It is precise, and with skilled operation it is accurate. The sensitivity limits are of the order of 10 ppm, although better sensitivity can be obtained under special and exacting conditions. The lack of sensitivity is sometimes a handicap, particularly in trace element analysis.

(Note: For more information and additional specifications, please review the Catalogue or contact us directly to discuss your specific Instrument of interest. Thank you for considering Analytical Technologies Ltd. to solve your lab automation requirements.)