Wavelength dispersive X-ray Fluorescence

Introduction:Wavelength dispersive x-ray fluorescence (WDXRF) is the old timer among commercial x-ray spectrometers, since the method works without high-resolution solid-state detectors. Instead, WDXRF instruments rely on diffractive optics to give them high spectral resolution. WDX spectrometers with simple electronic counting circuits were around well before the computer age, and are still the workhouse and leading performer for routine XRF analysis.

Hardware:WDXRF can be relatively simple and inexpensive, or complex and very expensive depending on the number of optical components. WDX instruments use a x-ray tube source to directly excite the sample. Because the overall efficiency of the WDXRF system is low, x-ray tubes in larger systems are normally rated at 1-4 kilowatts. There are some specialized low power systems that operate at 50 to 200 watts. A diffraction device, usually a crystal or multilayer, is positioned to diffract x-rays from the sample toward the detector. Diffracted wavelengths are those that satisfy the 2dnsin ? relationship, where d is the atomic spacing within the crystal, n is an integer, and theta is the angle between the sample and detector. Other wavelengths are scattered very inefficiently. Collimators are normally used to limit the angular spread of x-rays, to further improve the effective resolution of the WDX system. Because the detector is not relied on for the systems resolution it can be a proportional counter or other low-resolution counter capable of detecting a million or more counts per second.

All the components can be fixed to form a fixed single WDX channel that is ideal for analyzing a single element. A simultaneous WDX analyzer will have a number of fixed single channels usually formed in a circle around the sample with the x-ray tube facing upward in the middle. Other WDX analyzers use a goniometer to allow the angle (?) to be changed, so that one element after another may be measured in sequence. This type of instrument is a sequential WDX analyzer. There are also combined sequential/simultaneous instruments as well.

Applications: WDXRF can be used for a tremendous variety of elemental analysis applications. It can be used to measure virtually every element form Na to Pu in the periodic table, and some instruments can be used for quantitative or semi-quantitative work for even lighter elements. It can measure elemental concentrations ranging from a few ppm to nearly 100 percent. It can be used for monitoring major components in a product or process or the addition of minor additives. WDXRF is extremely popular in the geological field and is often used for measuring raw minerals, and finished products composed of minerals.