



X-Ray Diffraction Market in India

- Pranab Purkayastha

On 8th November 1895 the German physicist Wilhelm Conrad Roentgen discovered a new kind of rays while dealing with his research work at the Physical Institute of the University of Wuerzburg. He called them "X-rays". The discovery of X-rays had such a large impact on Science that it was rightly honored with the first Nobel Prize which was ever awarded, the Nobel Prize for Physics, in 1901.

There are many different ways Xrays can be put to use. One of them is the use of Xrays as an analytical tool. There are many types of analytical tools possible with Xrays and one of them is XRay Diffraction. X-rays, which have a wavelength comparable to the interatomic spacings of the sample, diffract off the atoms of the sample. In a crystal, the regular spacing of the crystal lattice gives rise to well-defined diffraction patterns that encode the physical structure of the crystal. Two more Nobel Prizes were awarded for the discovery and explanation of these XRD patterns by von Laue (1914) and the Braggs, father and son (1915).

Two distinct sectors characterize the XRD market. The first is the powder XRD, used mostly in the quality assurance applications for information on the presence of a given compound in a sample and the other is the single crystal XRD that is extremely useful in determining the molecular structure of a compound.

Powder XRD has many applications like Identification/quantification of crystalline phase Measurement of average crystallite size, strain, or micro-strain effects in bulk and thin-film samples, Quantification of preferred orientation (texture) in thin films, multi-layer stacks, and manufactured parts

Market Dynamics in India

- ⇒ The global market for XRD is growing by about 6 -7% . However, in India the market size has more than doubled in the last three years.
- ⇒ In the powder XRD segment the growth has been fuelled mainly by the Pharma Companies and the research in Nano Materials.
- ⇒ The estimated market size of XRD in this year will be around 60 units, valuing \$ 8 Million This is projected to reach about \$ 20Million in the coming three years.
- ⇒ The market for single crystal XRD is about \$3 Million. This will double in the next three years and will become five times in the next five years.

Determination of lattice parameters to quantify alloy content etc. The single crystal market is again divided into two Small molecule XRD system and Protein or Macromolecule XRD system.

The main players in the Powder XRD market in India are Rigaku, PanAnalytical and Bruker. There are many more players also in the field like Psifert, Shimadzu, GNR, Anton Parr, Bede etc.

The single crystal market the main players in India are Rigaku, Bruker, Marr Research, Oxford etc.

The XRD market Internationally is growing by about 6% in the last five years.

In the next five years it is projected to increase at the rate of 6 to 7%.

PRANAB PURKAYASTHA



M.Sc (Physics from IIT Mumbai), with specialization in Solid State Physics. Did the project in collaboration with Laser Physics Div. BARC in Excimer Lasers. Masters In Marketing Management (Jamnalal Bajaj Institute of Management Studies). Worked for a year as a lecturer in Physics for Degree College (SIES College Mumbai) Working for the past 19 years in IR Technology Services Pvt. Ltd looking after the Analytical Sales Group. This group deals in various analytical equipments dealt by Leco USA (Elemental analyzer, GCMS, GCGCMS, LCMS, Bomb Calorimeter, Nitrogen and Fat Analysers), Rigaku Japan (XRD, XRF and Thermal Analysers), HunterLab, USA (Appearance and Color measurement), Thermo Fisher (Cahn range of TGA/DTA and EGA), Milestone Italy. Visited different Principals like Thermo USA, Finnigan UK, Leco USA, Cecil UK, Rigaku Japan, CEM USA, Noran USA etc. for training and sales meets. Gave presentations in various National and International forums on XRD, GCMS, GCGCMS and ICP.



However in India the market size has more than doubled in the last three years.

In the powder XRD segment the growth has been fuelled mainly by the Pharma Companies and the research in Nano Materials. There is growth picking up in Steel and Cement sector also.

Pharmaceutical

X-ray diffraction is a direct result of the crystal structures which are present in the pharmaceutical under study. As such, the parameters typically associated with crystal structure can be simply accessed. For example, once an active drug has been isolated, an indexed x-ray powder diffraction pattern is required to secure a patent and protect the company's investment. An analysis of the active drug under most environmental conditions reveals the formation of any polymorphs that could adversely affect performance and toxicity.

The detection and quantification of polymorphic contamination can also be used to improve production efficiency and cost. Once the active ingredient is in the final dosage form the morphology parameters measured by x-ray diffraction can be directly related to the final drug performance.

For multi component formulations, the actual percentages of the active ingredients in the final dosage form can be accurately analyzed in situ, along with the percentage of any amorphous packing ingredients used.

X-ray diffraction is the key technique for solid state drug analysis benefiting all stages of drug development, testing and production

Nano Technology

The wavelength of X-rays is on the atomic scale, making X-ray diffraction (XRD) a primary tool for probing structure of nano-materials. The analysis of crystalline materials, semi-crystalline materials and amorphous materials to the nano-scale are possible with X-Ray Diffraction.

Crystallite dimensions and size are fundamental characteristics of nano-materials and microstructure (nanostructure) and can be important to understanding and controlling bulk properties. Small crystallite size results in broadened diffraction patterns. Analysis of peak shapes can give information about crystallite size and other aspects of microstructure, particularly lattice distortions (due to variations in composition or micro-strain) and faulting.

This financial year the estimated number of XRD's market will be about 60 units (Roughly about USD8Million). This is projected to reach about USD20Million in the next three years.

This financial year the market for the single crystal XRD is about USD3Million. This market is still dominated by the Research Institutes, Universities. Many Pharmaceutical companies are slowly entering the market for these facilities and the growth projected for this is similar where the market will double within the next three years and it will become five times this figure in the next five years. ■