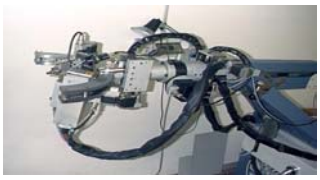
Strumenti e soluzioni per diffrazione raggi x

DIF-ROB

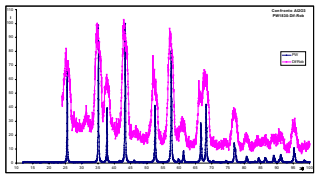
A NEW X-RAY DIFFRACTOMETER FOR ANALYSIS DIAGNOSYS AND CHARACTERISATION OF MATERIALS

THE X_RAY DIFFRACTOMETER is an electromagnetic waves analyzer, with a wavelength ten times smaller than a millionth of millimetre. The small size of the waves is right to analyse the quality of crystallites lattices, that compose all the known materials, from those with an excellent crystalline goodness (crystals, minerals, gemmas) to those with medium or low crystalline features. Between these two extremes are included metals, ceramics, polymers, proteins, and even glass and all type of materials that can be characterized by an aggregation of atoms. **DIF-ROB** has the structural ambition to satisfy these conditions. It can be identify as a wrist containing all the essential elements to realize measures and through automatics controls can advance the object. Unlike the lab diffractometers, the measure device is removable from the rigid support of the X-ray generator.

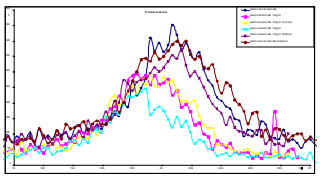
The prototype, in the first figure, has the capability of movement until six grade of freedom with a pointing device controlled by a optical visible system (i.e. camera and laser) and with a distance control for the operation of pointing and measure. The initial results, obtained thorough a minimal x ray optical (i.e. using only the divergence slits on the incident and diffracted beam) offer satisfactory results. The purpose now is to engineering the prototype for specific applications, and add an X-Ray optic adapt to the applications and the need of the final user.



The figure in the centre, represents the difference between two diffraction patterns of Alumina (Corindone), obtained with DIF-ROB (equipped with an essential optic - pink line) and a traditional diffractometer (equipped with a more sophisticated optics: double Soller slit, monocromator - Blue line).



In the figure at the bottom, it is possible to identify the shift of the diffraction lines, obtained by a block of aluminium subjected to different mechanic loads. It can be noted that the peak shifts are proportional to the lattice deformation induced by the loads.



The general configuration of the goniometer is the theta-theta type, where the source and the detector move in different directions. The instrument can be considered as an industrial robot, in which the main arm, meter, include the following equipments:

- a double Eulero's cradle that supports the diffraction devices, giving diffraction measures. The main Eulero's cradle contains the source, detector, where can be installed different optical devices for applications with parallel or divergent beam . The main Eulero's cradle has a ray of about 20 cm. The collimation of the incident and diffracted beam can be optimized to minimize the radiation dispersion in the system.
- A movable device with three translational grades of freedom and one rotation grade of freedom. The system is equipped with 8 stepping motors that give all movements for the fine positioning and the control of the diffractometer performances.
- Pointing devices and optical detectors (es: small laser and a colour camera), with a software of control that help the positioning and the measure. The remote control is based on programmable micro-processors that activate even the movements of the 8 step motors.

APPLICATION FIELDS

Superficial Analysis for large number of different materials (typical penertrations are from few nanometers to several hundreds of microns). Almost all the condensed materials and all those presenting crystalline status and aggregation. Several sectors are covered : Aeronautics, Automotive, Energy, Cultural Heritage - and many others

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