Introduction to X-Ray Diffraction. From Materials Research to Industrial Process Control.

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X-ray diffraction (XRD) is an analytical technique that is widely used in materials research, but also in industrial applications ranging from characterization of raw materials in mining and cement production to quality control in pharmaceutical and semiconductor manufacturing. Unlike X-ray fluorescence, which is used to analyze the chemical composition of a substance, XRD mainly gives information about the phase composition and allows to determine in which crystalline phases certain elements are present. This information is often crucial for the industrial processes because every crystalline substance has different physical and chemical properties (reactivity, temperature stability, etc.), which determine its behavior under treatment. In addition, properties such as crystallinity, crystallite size, lattice strain, oxidation states and much more can be derived from XRD data.

In this presentation several examples are discussed, which demonstrate the application of XRD for characterization of materials in research and industrial processes.