NRC·CNRC
INFORMATION

Neutron Program for Materials Research
Applied Neutron Diffraction for Industry (ANDI)

Phase Analysis

Quality Assurance
Product Development
Process Evaluation
Non-Destructive Test
***In-Situ* Measurement**

The Need

Certain products (e.g. ceramics, welds, metal-matrix composites) may consist of many crystalline *phases*. The identification of these phases, and the proportion of each in the product can be very important in determining its usefulness or reliability.

The Technique

Neutrons can pass through centimetres of most materials and are diffracted from every phase they encounter. Each phase has a characteristic unit cell and interatomic spacings, *d*.

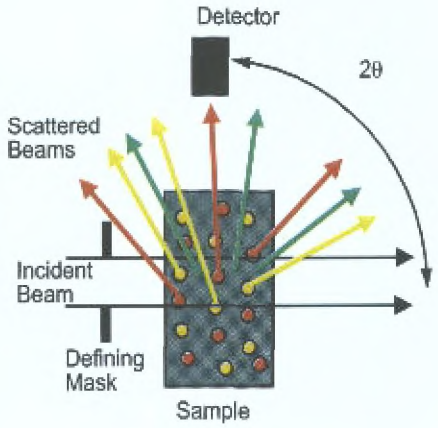

Fig 1. Scattering from a multiphase sample gives a composite diffraction pattern, with lines characteristic of each phase

Bragg's Law, predicts exactly the angles of scattering, 2θ, at which diffraction peaks occur.

The result is a composite diffraction pattern, consisting of peaks characteristic of each phase in the sample. The ratio of the intensity of the diffraction peaks can directly yield the volume and weight fractions present. Using this information **Quantitative Phase Analysis** can be performed.

Due to the great penetrating ability entire specimens of product can be examined *without* the need to grind the sample into a powder, completely **non-destructively**, and complex sample environments can constructed around the sample.

Depending on the requirements, either the *bulk* composition can be examined by bathing the entire sample in the beam, or the *composition as a function of depth* can be examined, by masking the incident beam and detector.

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