

What can XRD tell us?

NaCl ZnO
KCl TiO₂

TiO₂ (Rutile) 60%
TiO₂ (Anatase) 30%
ZnO 10%



XRD can tell us what crystalline materials are included in powder or polycrystalline bulk samples.

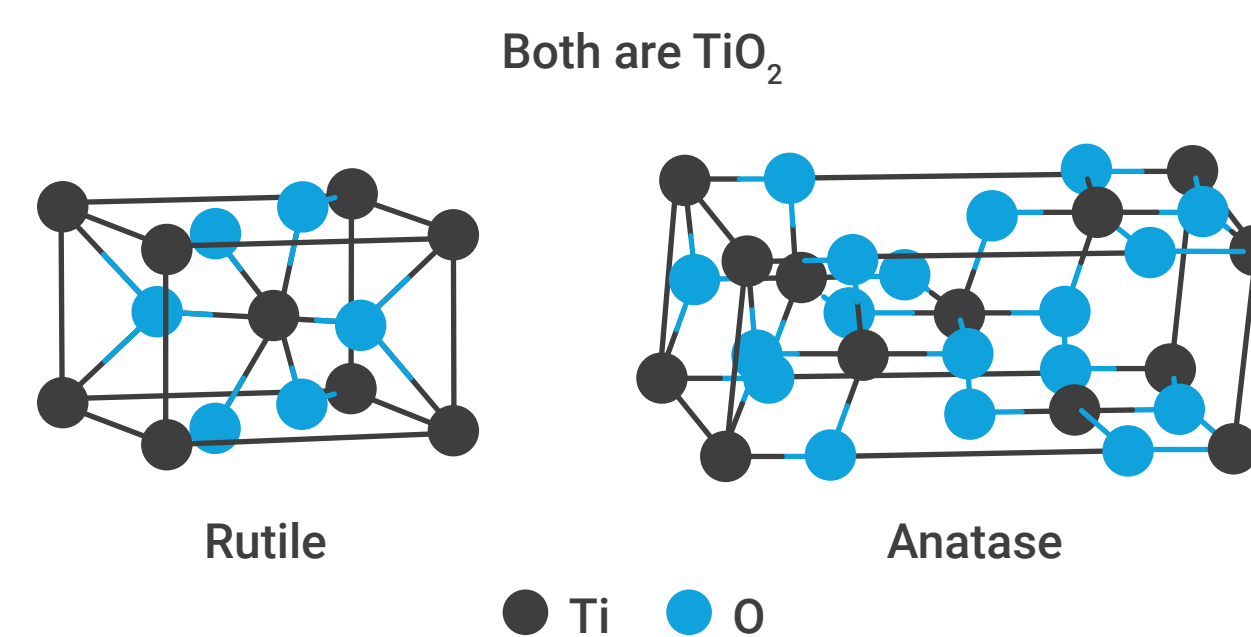
What are the benefits of XRD?



Non-destructive

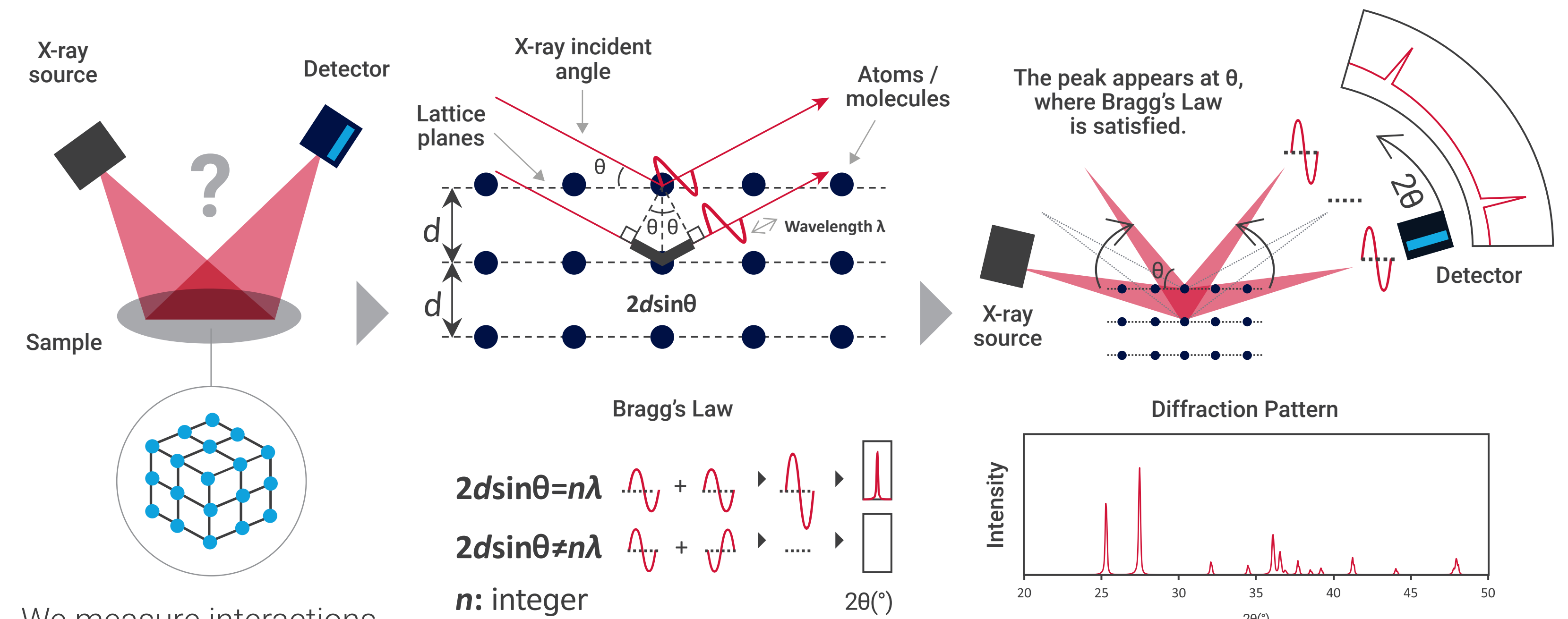


Small sample amount



Polymorph differentiation

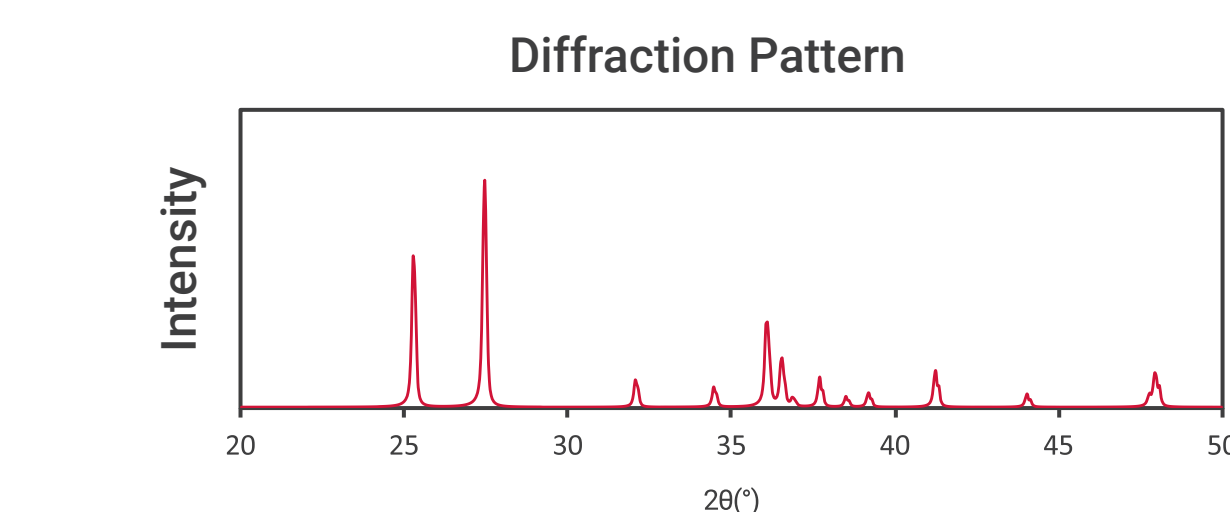
How does XRD work?



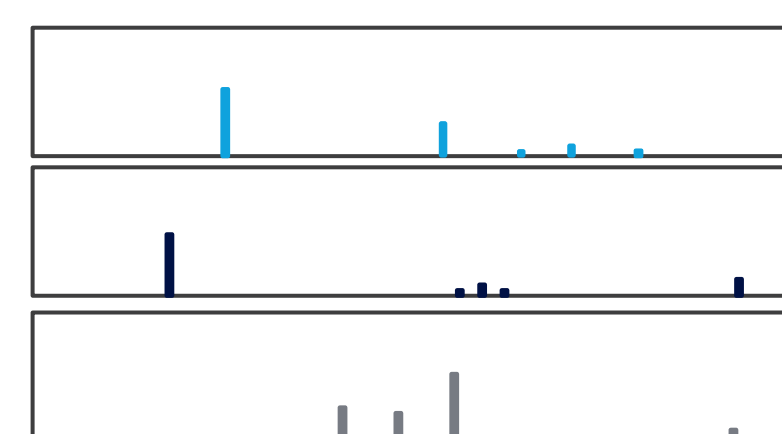
We measure interactions between X-rays and a sample using a diffractometer.

When the wavelength λ is known, the lattice spacing d of the constituents of the material can be determined from the diffraction angle θ .

How can XRD identify materials?



Known Patterns in a Database

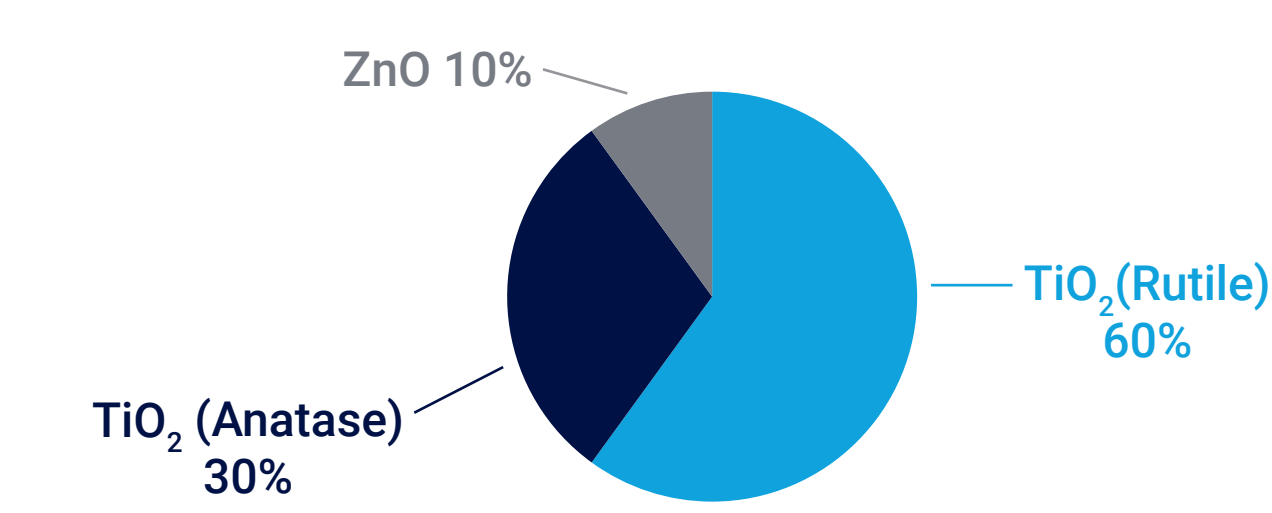
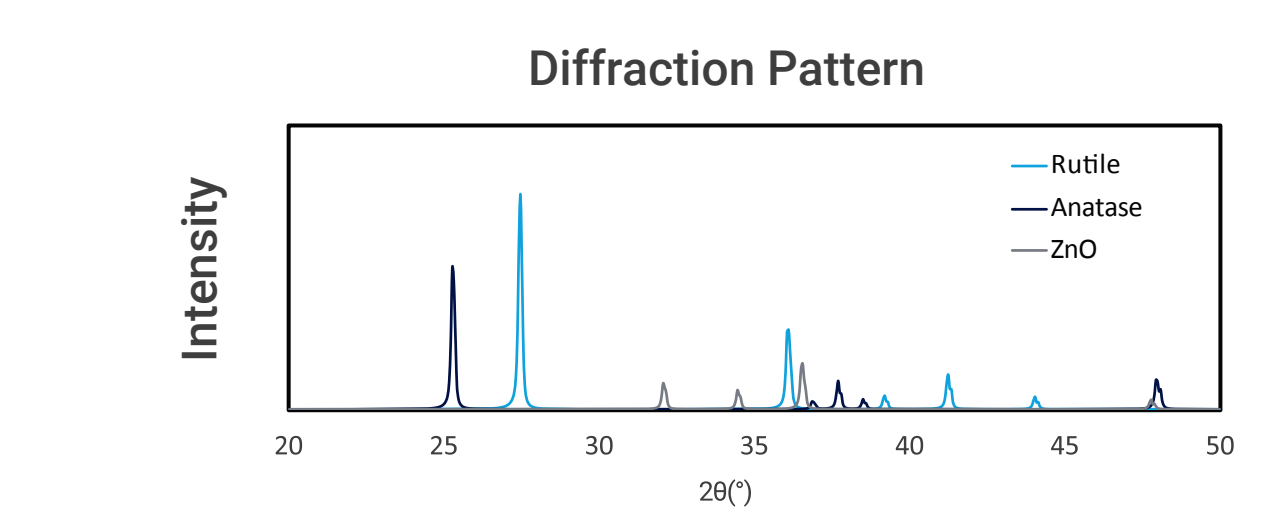


A mixture of
Rutile,
Anatase,
and ZnO



We can identify the components by comparing the observed diffraction patterns to the known ones in a database, focusing on matching peak positions and relative intensities.

How can XRD quantify materials?



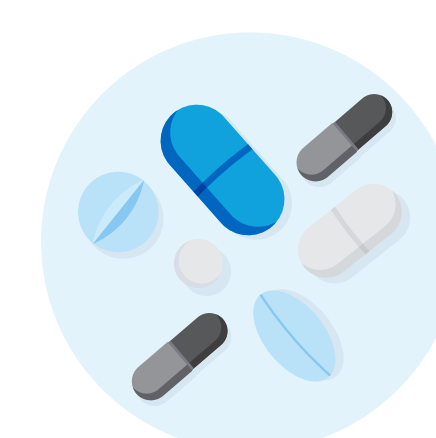
The total peak areas of a component are approximately proportional to its amount. Comparison of these total areas can provide the weight percentage of each component.

Where is XRD used?



Cement Industry

Example: Identify components of cement, including crystalline and amorphous, and perform quantitative analysis of free lime (CaO) in raw materials.



Pharmaceutical Industry

Example: Distinguish and control the amounts of polymorphs with different solubility and absorption rates in the body.



Geology and Mining Industry

Example: Identify crystalline phases of minerals in iron ores mined in different localities.



Battery Industry

Example: Observe changes in crystal structure during the charging/discharging process.

Rigaku's XRD Instruments



MiniFlex



SmartLab



SmartLab SE



MiniFlex XpC



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