

Corrosion reduces structural integrity and can ultimately lead to part failure, furthermore, both scale and corrosion products can result in blockages and result in costly downtime and repairs. Powder X-ray diffraction is a powerful technique which allows rapid identification of scale and corrosion products. While chemical analysis methods can be used to determine elemental composition they cannot identify what phases are present in scale and corrosion products. In addition, powder XRD can also distinguish between polymorphic phases with the same chemical composition.



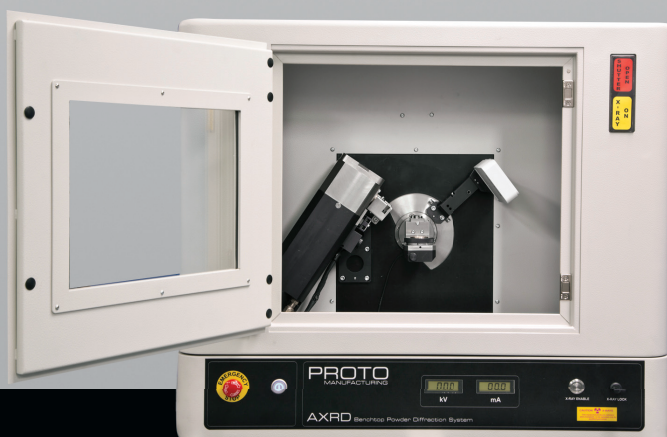
For example, Calcium carbonate (CaCO_3) a common scale product, is mainly found in the form of calcite, however, it is also found as other polymorphs, such as aragonite or vaterite depending on the environmental conditions present during formation.

Iron based corrosion products e.g. rust are perhaps the most common type of corrosion products analyzed. Iron(III) oxide-hydroxides can also be found in various polymorphic types such as lepidocrocite, ferrihydrite, and ferrihydrite, which can only be identified using XRD.

Variations in temperature, acidity or basicity, dissolved gases and ions, and pressure can all effect which phases are formed during the corrosion/scaling process. Identifying the phase composition is critical to understand how the corrosion/scaling process is occurring and ultimately locate the source of the problem and the appropriate solution.

Corrosion Identification Utilized In:

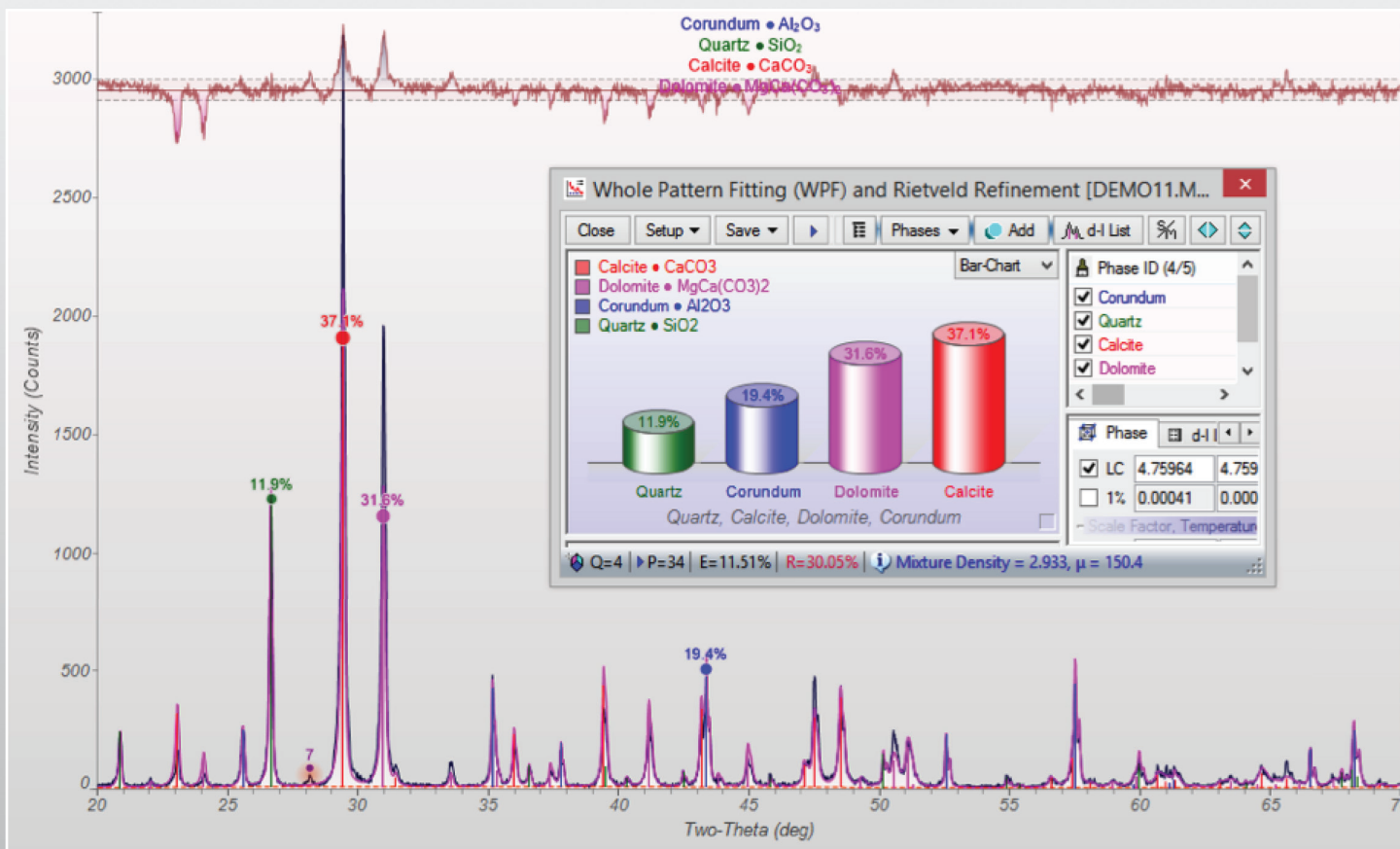
- Pipelines
- Flue Stacks
- Pressure Vessels
- High Temp Applications
- Mechanical Components
- Valves
- Furnaces
- Boiler Tubes
- Drilling Equipment
- Petroleum Industry



XRD Analysis of Scale and Corrosion Products:

X-ray diffraction (XRD) is a powerful technique which allows rapid phase determination and quantification of minerals formed by scaling and corrosion. XRD allows for phase identification of crystalline materials by comparing a collected diffraction pattern with a reference pattern of a known material in a database, such as the ICDD Powder Diffraction File (PDF). Quantitative multiphase analysis is made possible by Rietveld analysis on a X-ray diffraction pattern with MDI's sophisticated Jade XRD analysis software.

JADE XRD Analysis Software



Through the use of our economical benchtop AXRD unit coupled with powerful JADE XRD analysis software one can perform quantitative phase analysis utilizing Rietveld refinement to determine the composition of various types of corrosion and scale products.

Common Industrial Scale and Corrosion Products	
Phase	Chemical Formula
Calcite	CaCO_3
Magnetite	Fe_3O_4
Hematite	Fe_2O_3
Lepidocrocite / Goethite	$\text{FeO}(\text{OH})$
Cuprite	Cu_2O
Brucite	$\text{Mg}(\text{OH})_2$