

Using Portable XRD (pXRD) to Analyze Explosives, Forensics, and Narcotics

Olympus X-ray diffractometers aid law enforcement agencies by providing qualitative and quantitative phase analysis on a range of substances, including narcotics and explosives/hazardous materials as well as materials analyzed by

forensics and customs officials. The unique sample handling system enables our instruments to be easily transported between sites, while eliminating the need for complicated sample preparation procedures.



Flexible sample loading options

Since different applications have different sample handling requirements, our pXRD analyzers are flexible and minimize the work of sample preparation and loading procedures.

The vibrating sample holder makes loading samples easy. It is recommended for non-energetic material that is, or can be powdered to $< 150 \mu\text{m}$.

The sample spinner is recommended when a sample cannot be powdered (e.g. explosive material), is $< 10 \text{ mg}$, is a liquid, or is moist (Figure 1). The sample spinner cells are easy to assemble and can be stored away for analysis at a later date.

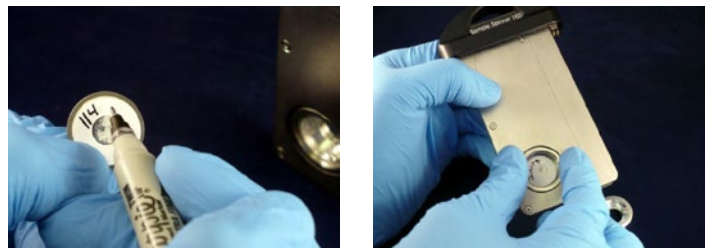


Figure 1A. Olympus spinner cells can be easily assembled and labeled for archiving. (B) Loading samples within the sample spinner.

Benefits of Olympus pXRD

- Small sample size: requires only $\leq 15 \text{ mg}$ of material
- Easy sample preparation: does not require a skilled technician
- Fast acquisition time: obtain results in few minutes
- Portable: battery-operated, rugged design with no moving parts
- Stand-alone instrument: no need for water cooling or a large, external power source
- No ongoing servicing requirements: XRD can be performed regularly with minimal downtime
- Qualitative XRF: measured simultaneously during each test

One instrument, many applications

Explosives

Olympus pXRD instruments:

- Provide rapid identification of explosives and precursor material
- Identify and quantify impure and diluted explosives and precursor material
- Analyze organic and inorganic crystalline material, irrespective of reflectance or bonding-types
- Do not require a heat source to analyze the sample
- Can safely analyze energetic samples using the sample spinner (Figure 1B)

Narcotics

Olympus pXRD instruments enable users to:

- Rapidly identify and quantify controlled substances and precursor chemicals onsite
- Identify and quantify impure and diluted controlled substances and precursor material
- Analyze moist or wet samples

Most illicit drugs are mixed with filler material or masking agents. Many onsite and laboratory analyzers (e.g. infrared, raman) cannot identify these impure substances. With Olympus pXRD, illicit substances can be both identified and quantified (Figure 2).

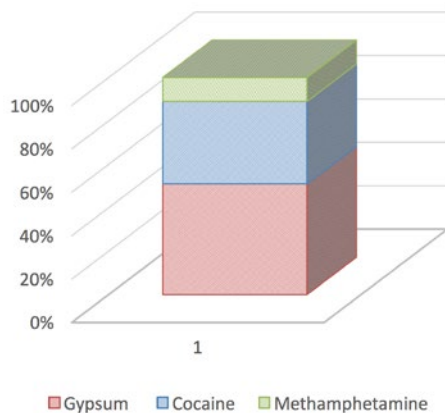


Figure 2. Controlled substance analyzed with Olympus XRD. The sample contains an appreciable amount of gypsum (filler material), as well as illicit drugs, cocaine and methamphetamine. Using infrared spectroscopy, this impure drug was not recognized as cocaine or methamphetamine. With Olympus XRD, not only was the illicit drugs identified, they were quantified to help further investigations.

Forensics

Use Olympus pXRD instruments to:

- Nondestructively analyze a large range of materials (e.g. soil, paint)
- Analyze samples ≤ 15 mg onsite without technical sample preparation procedures

With Olympus pXRD instruments, forensics teams have the flexibility of analyzing the samples back at the lab or onsite. By analyzing samples onsite, forensics teams can determine which samples they will retain for further analysis (Figure 3).

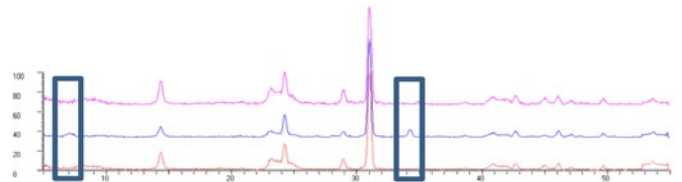


Figure 3. XRD traces from soil samples collected from the shoe of a victim (red) compared to soil collected from the shoes of two suspects (blue and pink). The XRD traces collected onsite suggest the blue suspect was not at the crime scene as there are peaks at 7 and 34 degrees 2θ , which are not present in the XRD trace of the victim.

Customs

Olympus pXRD instruments enable users to:

- Verify the composition of goods being imported or exported
- Analyze unknown samples onsite
- Quickly and easily prepare samples
- Email data back to a regional hub for analysis

Before cargo leaves or enters a country, it is important to know the composition of the goods. Since our instruments do not require technical expertise to load or unload a sample, samples can be easily analyzed onsite and the data emailed to a customs official for further analysis.

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