

# Mass Spectrometry & Spectroscopy

## The importance of using advanced XRF technology for real-time gold purity assessment

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While most precious metals typically hold their value over time, gold often fluctuates – largely driven by inflationary expectations, interest rates, and outlook on future macroeconomic conditions [1]. According to Goldman Sachs, gold became one of 2024's most sought-after commodities, rising more than 30% to record high prices, and the analyst group expects to see an upwards of 8% increase in 2025 [2]. With continued interest in gold, advanced technology that offers buyers and sellers accurate, real-time gold purity analysis is critically important.



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### The need for accuracy with a fluctuating commodity

As an often highly sought-after commodity and in an industry where reputation and trust are paramount, knowing gold purity is essential for manufacturers and retailers, buyers, and governing bodies. For example, before commencing production, jewellery manufacturers must authenticate the composition of precious metals without damaging pieces like necklaces or ring shanks. For regulators, ensuring counterfeit gold is of utmost importance as, especially with the volatility and high price of gold, failing to detect a slight variation in composition can be an expensive mistake. Retailers must adhere to gold purity standards, such as karat count, which also helps to determine the value of the gold and eliminate counterfeit gold from the market.

In addition to testing for karat count and purity, retailers also test to combat a common type of fraud: gold plating. Gold plating is where a less valuable metal is coated with just a thin layer of gold, and testing can identify what other alloying elements make up the composition of the jewellery. Traditional testing methods, such as acid testing, can be inaccurate. Acid testing is also destructive and uses dangerous chemicals that can harm those performing the tests and the gold itself.

Technologies that allow for real-time, non-destructive testing, such as handheld X-ray fluorescence (XRF) analysers, are essential for those working with gold. Accurate analysis of gold purity ensures counterfeit gold is eliminated from the market and helps build trust between retailers and consumers.

### Common challenges with traditional acid testing methods

Traditional gold testing methods consist of placing a small drop of a strong, corrosive acid, such as nitric acid, onto the metal's surface. The acid will react with most metals by fizzing and bubbling upon contact, but not with precious metals. Although results have often been considered reliable, retailers and regulators should consider several disadvantages, such as lack of precision and mandatory destruction.

Acid testing is inherently less precise than newer testing methods. For example, acid testing cannot give an exact karat. It only provides rounded measurements, which is insufficient for those in the gold retail business, especially as the karat count impacts the value of the gold. Additionally, acid testing commonly mistakes stainless steel alloy grades as 18K white gold, even if they contain zero percent precious metal. In instances where there are other metals or alloys, acid testing cannot tell users what other elements make up the composition. Items with iron and steel, such as platinum jewellery, may need additional testing with a powerful magnet to identify their presence. This can be both time-consuming and leaves room for error.

The acids used in this testing method are highly potent, so they can be dangerous to handle and potentially unhealthy for users if they're not handled with extreme care and stored in a safe space. Lastly, acid testing requires that users scratch the surface of the metal before the acid is applied, which harms the product. For items that may be gold-plated, users must put a deep scratch in the metal to determine if plating is present or if it's solid gold. This can significantly impact the value of the final product.

Fortunately, there are non-destructive testing methods regulators, manufacturers, retailers, and buyers can use to quickly and accurately measure gold purity. Advanced technologies, such as XRF analysers, are critically important for use in the gold industry, where the value of the commodity fluctuates frequently.

## Overcoming industry challenges with advanced technologies for non-destructive testing

XRF is a non-destructive analytical technique used to determine the elemental composition of materials. Handheld XRF analysers measure the fluorescent, or secondary, X-rays emitted from a sample when excited by a primary X-ray source. Each element in a sample produces a set of characteristic fluorescent X-rays, or 'unique fingerprints'. These 'fingerprints' are distinct for each element, making handheld XRF analysis an excellent tool for quantitative and qualitative measurements. XRF technologies offer a standard analytical range of 22 elements so that users can measure the content of all precious metals without changing the analyser's calibration – from gold to silver to platinum to palladium.

There are several benefits of using XRF technology for gold analysis. First, it provides a fast, accurate, and, most importantly, non-destructive method to test the purity and chemistry of all precious metals. Additionally, many analysers are handheld, offering point-and-shoot simplicity and delivering accurate analysis in just seconds on an easy-to-use device with a familiar digital interface. XRF technologies are a highly accurate solution that eliminates the need for testing with harsh chemicals.

Using XRF technologies, manufacturers can confidently produce finished pieces, ensuring their reputation remains intact, and unauthenticated metals do not enter their production line. Retailers, such as pawn shops, can efficiently identify gold-plated items

and precisely determine the presence and concentration of other trace alloying elements and dangerous heavy elements, which could impact valuation and future refining needs. This also helps them negotiate the best price for their business in real-time.

## Navigating market volatility with real-time analysis and accurate data

Gold prices will continue to fluctuate as a commodity linked to macroeconomic and geopolitical trends. Advanced technologies that offer real-time and accurate data are critical to helping buyers and sellers navigate market volatility. For regulators, advanced XRF technologies allow compliance with accurate data records as the fight against counterfeit gold continues.

Broader adoption of advanced XRF technologies allows for more sustainable and healthier practices across the gold industry. With less damage to items via acid testing, the industry can reduce waste and eliminate interaction with harmful acids, making for a healthier and safer gold ecosystem.

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## References

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