

# Tools used by Gemologists

While some gemstones are readily identified on sight, even by novices, many of them are quite similar in appearance and cannot reliably be identified on visual appearance alone. The tools used by gemologists for the identification and grading of different gemstones range from the simple and familiar to the high-tech and exotic. Most gemstones can be identified by a few basic tools that every gemologist should have at hand. Often, a single test is not conclusive, and a gemologist often needs to perform several different tests to achieve a positive identification.

One of the most useful tools for gemologists is the binocular microscope. Simple models such as the one shown here may be obtained for a few hundred dollars, but better scopes with enhanced accessories typically cost several thousand dollars. These scopes provide both light field (lighting from below) and dark field (lighting from the side) views and usually have a magnification range from 10X to perhaps 100-200X. Magnifications of 10X to 40X are most often used, but the higher range is sometimes needed for careful inspection of inclusions.



Another required tool for gemologists is the refractometer. A small drop of liquid with a high refractive index (RI) is placed on a glass cylinder in the top of the refractometer and illuminated from a separate light source (sometimes white light, but a monochromatic light source provides better accuracy). The RI is then read from a magnified gauge on the front of the refractometer.

The polariscope has two polarizing filters and a light source below. As the upper filter is rotated, it allows a varying amount of light to pass through the system. A transparent gemstone held and turned between the crossed filters shows different patterns of light, depending on its optic character, and this can often be used to distinguish between different gemstones with similar appearance.



A Chelsea filter, aka emerald filter, is sometimes useful in distinguishing between natural and synthetic emeralds or between aquamarine and blue topaz, but its usefulness and reliability are quite limited, so it has declined considerably in importance over recent decades.

The spectroscope is sometimes used to separate natural from synthetic gem materials, as variations in chemical composition can be revealed in the absorption spectrum of light transmitted through the stone. These instruments can be quite simple, as shown here, or much more elaborate. The average gemologist is unlikely to use this very often, but the more specialized gem trade labs use spectroscopes frequently to identify difficult materials.



An ultraviolet (UV) light source, or black light, will reveal fluorescent activity in many gem materials, and this can help to identify many stones.

Hardness points, intended to test the scratch resistance or hardness of a material, are very rarely used by gemologists, because they are by nature destructive. Occasionally, a gemologist will attempt a very small scratch in an inconspicuous area of an object, such as a sculpture, but such tests should never be used until other tests are exhausted, and a faceted stone should never be subjected to a hardness test.

Sets of several liquids of known specific gravity (SG) are sometimes used to distinguish between various materials that closely match in other characteristics. As the substrate of SG liquids evaporates, the SG changes, so such test sets must be recalibrated periodically. Specific gravity can also be tested on weight scales by comparing the weight of an object immersed in water with the weight of the object in air. Another test often used to distinguish amber from its substitutes is simple immersion in a saturated salt solution; amber floats in salt water, but most of its imitations sink.

X-ray photographs are sometimes used, as in the separation of natural pearls from cultured pearls, and x-ray diffraction techniques are used in advanced laboratories.

A heated point can be used to separate some organic materials from their substitutes. For example, a hot point will elicit a sweet resinous smell from amber but an acrid odor from plastic.