Long-wave Ultraviolet Torches • A Gemmologist's New Best Friend
紫外線長波手電筒 • 寶石鑑證師的新摯友

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作者簡介數款常用的紫外線長波手電筒，並著重於運用紫外線手電筒配合顯微鏡，一起應用於有色寶石的檢測。

As laboratory gemmologists, we are frequently asked by friends and colleagues for recommendations on lab equipment. Often the focus is based around the most modern and advanced instrumentation, much of which is out of reach for what my grandfather likes to call the "great unwashed."

One piece of equipment that is often overlooked is the humble ultraviolet (UV) lamp. Although it is an older and relatively affordable tool, it is an essential test in our laboratory, and we examine all submitted stones under UV light. Often used in diamond testing, it can also be a tremendous help with coloured gems, in detecting treatments and synthetics, as well as a capable tool to screen pieces of jewellery with many smaller stones.

One way this can help gemmologists is with emeralds. As gemmologists are aware, the vast majority of emeralds are filled with oils or resins to mask their fissures. Thankfully, many of these fillers fluoresce to long wave (LW) UV. While a standard UV lamp can unmask this, it's even better if the fluorescence can be observed under magnification.

That leaves gemmologists with two choices. Rig up a contraption with a lens attached to the UV light box (Hughes and Emmett, 2005), or buy an expensive fluorescence microscope.

While we have an excellent LW/SW UV microscope setup custom-designed by M&A Instruments, it does not produce strong reactions in LW illumination. Similarly, our standard UV light box's long wave bulb (a UVP UVLS-26 EL Series UV 365nm, 6-watt model lamp) is reasonably strong, but lacks the magnification that allows us to see the details we get from our microscopes.

Fig. 1 UV blocking goggles offer eye protection when using UV illumination.
Photo © Chanon Yimkeativong, Lotus Gemology
在使用紫外線照明時，防紫外線護目鏡可保護眼睛。

Fig. 2 A selection of long-wave ultraviolet fluorescent torches available on the market. From top to bottom: Convoy S2+ 4-watt UV, GEMA UV 365nm & World Jewelry Tool Gem Torch BK19-UV.
Photo © Wimon Manorotkul/ Lotus Gemology
市面上有多種紫外線長波熒光手電筒。從上到下：Convoy S2 + 4瓦紫外線，GEMA 365nm紫外線和世界珠寶工具Gem Torch BK19-UV。

Enter the LW UV torch. While many gem dealers have started carrying these portable torches around when they buy and sell stones, we have also found them to be of great use in the lab. By examining a stone under the microscope and illuminating it with our UV torch, we are able to get the best of both worlds in a simple and affordable manner. This combination provides the advantages of microscope magnification and the utility of LW UV illumination, creating a "poor man's fluorescence microscope" that is even better than the real thing. At about US$50, it is something any gemmologist can afford.

One of the strongest of these torches we have seen is the Convoy S2+ 4-watt UV Flashlight (Fig. 2), a 365 NG source. This is produced by Way Too Cool LLC and made with the mineral community in mind. It produces a significantly stronger reaction than the others we have tested and is the one we use most often in conjunction with the microscope. They also produce an even stronger 6-watt version, which we have not tested.

One huge benefit of the torch is with oiled gemstones. We find more and more gems are being oiled today, particularly those originating from Myanmar (Lotus Gemology, 2015). Not only can you see where oil has penetrated fissures, but with the microscope you can make better judgements about the extent of the treatment (Fig. 3).

Ultraviolet Safety Considerations

One should never point these UV torches directly at one's eyes. To protect one's eyes while using UV lights, one can easily and affordably purchase UV blocking goggles. These are available for less than US$10.

Another interesting use is for photomicrography. When viewing fluorescent inclusions, such as petroleum in quartz, the UV torch can produce spectacular reactions that were previously difficult to capture (see Fig. 4).

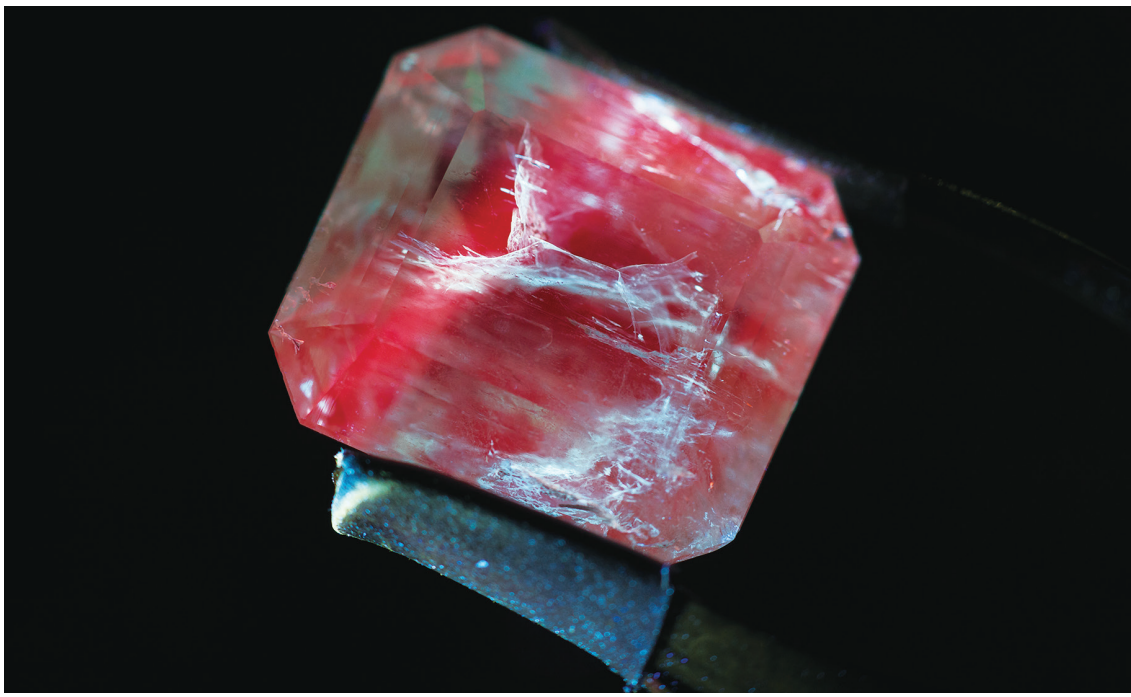

Fig. 3 When viewed with the Convoy S2+ torch, this Colombian emerald displays a red fluorescence in LWUV. However, the fissure-filling displays a chalky blue reaction because the filler in the fissures (not itself tested and identified) is fluorescing as well.
Photo © E. Billie Hughes/ Lotus Gemology
使用Convoy S2 +手電筒觀察時，這顆哥倫比亞祖母綠在紫外線長波中顯示紅色熒光。但是，由於裂縫中的填充劑（未經測試和鑑定）也有熒光現象，因此裂縫填充物顯示出白堊藍色的反應。

Fig. 4 A cavity in quartz filled with petroleum. In light field (left), the petroleum displays a yellow appearance. When illuminated with the UV torch (right), in this case with the Convoy S2+, the petroleum fluoresces a chalky yellowish white, creating a totally different look and feel.
Photos © E. Billie Hughes/ Lotus Gemology
石英的腔洞中充滿石油。在光域照明（左）下，石油顯示為黃色。（右）當用紫外線手電筒（Convoy S2+）照射時，石油發出發白的黃白色熒光，因而產生完全不同的外觀和感覺。

Conclusion

Whether to help detect treatments or to view other fascinating LW fluorescent reactions, these UV torches are a great addition to any gemmologist's instrument collection, and even better when paired with a microscope. With one of these, the great unwashed can proudly point their noses in the air and say "Ha! I can do that, too."

References

Hughes, R.W. and Emmett, J.L. (2005) Heat Seeker: UV fluorescence as a gemological tool. *Gem Market News [The Guide],* Vol. 24, No. 5, Part 1, Sept.–Oct., pp. 1, 4–7

Lotus Gemology (2015) Lotus Gemology lab alert for oiled gems. *InColor.* Spring, Issue 28, pp. 18–23

About the Author

E. Billie Hughes, FGA, of Lotus Gemology in Bangkok, visited her first gem mine at age two. Billie's photographic work has been widely published and she is also an award winning photomicrographer. She has lectured internationally. Her articles, gemmological images and photomicrographs have appeared in *Gems & Gemology, The Gemguide, The GAHK Journal* and *InColor* magazine.

(While this article deliberately focuses specifically on the actual use of the UV torch in conjunction with a microscope for coloured gemstone testing, it may well raise some questions about the wider use of these torches - perhaps particularly in the diamond industry. This could usefully be the subject of a separate article in the future. Ed.)

For further reading in that context, the following have been suggested:

Robbins, Manuel. (1994) Fluorescence . Gems and minerals under ultraviolet light. Geoscience Press, Inc., Phoenix, Arizona. ISBN 0-945005-13-X

Faber, Lily, (2020) Gem-A: FOCUS ON GEMSTONE FLUORESCENCE: LOOKING FOR THE LIGHT https://gem-a.com/gem-hub/gem-knowledge/focus-on-fluorescence