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Jaipur's Gem and Jewelry Industry

The Earliest Gem-Quality Synthetic Emeralds

A New Source of Danburite from Vietnam

A Chart of Emerald Inclusions

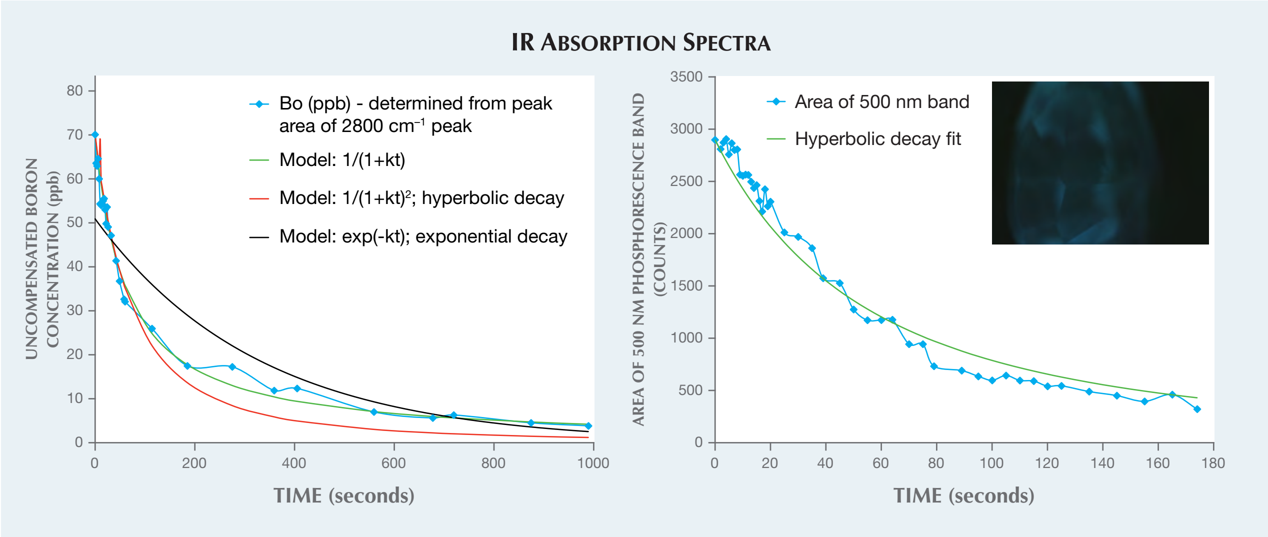


Figure 6. Left: The uncompensated boron concentration for the IR absorption spectra in figure 5 were calculated and compared against several phosphorescence decay models. Right: The decay of the phosphorescence peak at 500 nm, also induced by UV excitation, was calculated and compared against the accepted model for phosphorescence. The DiamondView image shows the diamond's blue phosphorescence.

gen, the 2800 cm^{-1} peak would not be detected and a nominally type IIa diamond would be recorded by IR absorption. However, UV excitation creates a charge transfer effect, temporarily uncompensating some of the boron so that the Bo concentration temporarily increases. This absorption decay of the 2800 cm^{-1} peak is most dramatic in nominally type IIa diamonds such as this sample, but has also been observed to a lesser extent in type IIb diamonds. There are several unanswered questions regarding the phosphorescence mechanism and decay kinetics in type IIb diamonds, and further study of this absorption decay will help address these issues.

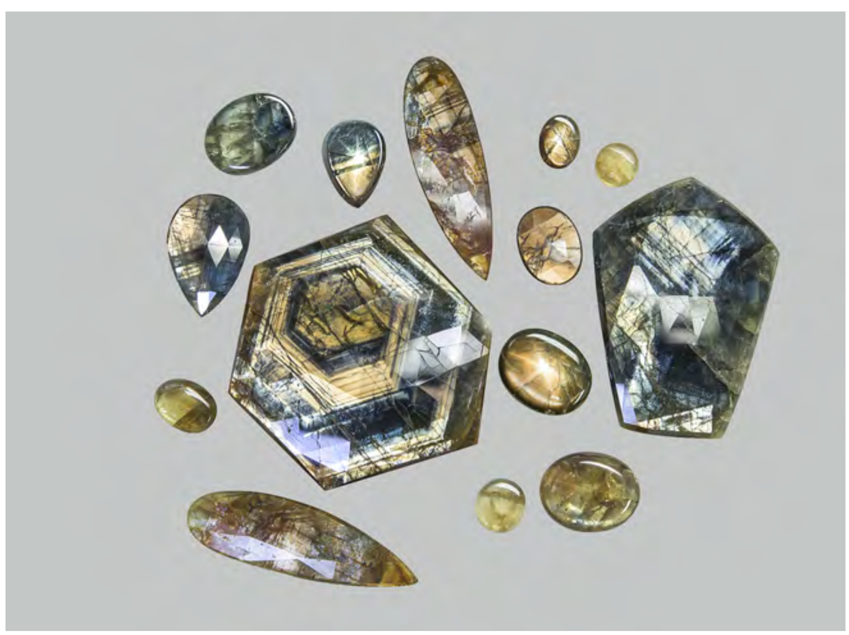
Sally Eaton-Magaña

Update on Spectroscopy of "Gold Sheen" SAPPHIRES

Sapphires displaying a golden sheen, known in the trade as "gold sheen" or "Zawadi" sapphires, entered the gem market in late 2009. These sapphires are mined in eastern Kenya (T.N. Bui et al., "From exsolution to 'gold sheen': A new variety of corundum," *Journal of Gemmology*, Vol. 34, No. 8, 2015, pp. 678–691). They contain dense needles and platelets of hematite/ilmenite inclusions, which are responsible for producing a golden shimmer on the surface.

Recently, GIA's laboratory in Bangkok received 14 gold sheen sapphires of various shapes and cuts. The samples had yellow and green to blue bodycolor, were transparent to translucent, and weighed 1.06 to 97.69 ct (figure 7). Their physical properties and inclusions were similar to those of gold

Figure 7. These 14 sapphires, weighing up to 97.69 ct each, displayed a golden sheen effect and in some cases six-rayed asterism. They possessed sufficiently large inclusion-free areas to enable good-quality spectra.



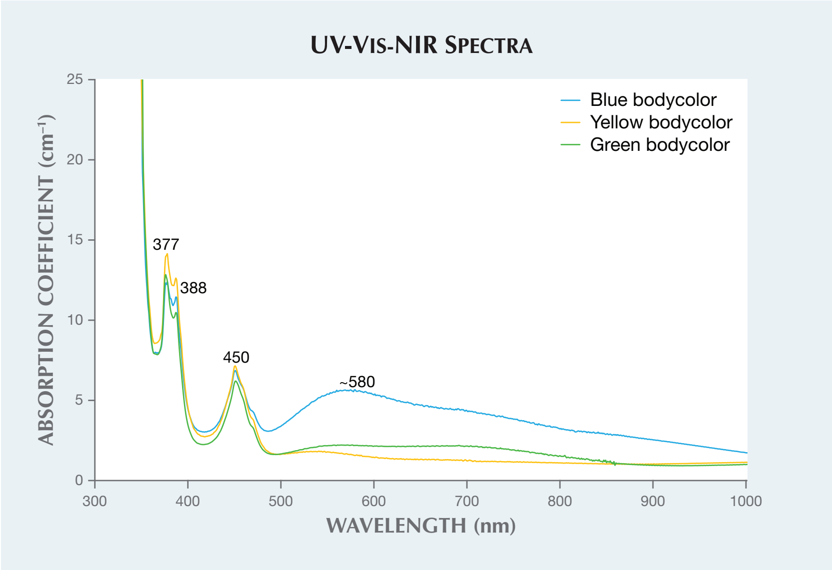


Figure 8. The UV-Vis-NIR spectrum of a gold sheen sapphire with yellow bodycolor revealed strong Fe-related absorption features at 377, 388, and 450 nm. The spectra of green to blue samples revealed an additional Fe^{2+}-Ti^{4+} intervalence charge-transfer band centered at around 580 nm. These samples were not specifically aligned to the c-axis.

sheen sapphires described in Bui et al. (2015): an RI of 1.762–1.772, a birefringence of 0.008–0.009, a hydrostatic SG of 3.98–4.01, an inert reaction to long- and short-wave UV radiation, and an abundance of hematite/ilmenite platelets. Since the samples had some transparent windows, UV-Vis-NIR spectra were analyzed.

The UV-Vis-NIR spectra all displayed strong Fe-related absorption features at 377, 388, and 450 nm. Samples with a yellow bodycolor showed mainly the three Fe features, whereas the green to blue sapphires revealed a band centered at around 580 nm that is related to Fe^{2+}-Ti^{4+} intervalence charge transfer, in addition to the three strong Fe features (figure 8). LA-ICP-MS analysis on inclusion-free areas showed high Fe ranging from 2550 to 3260 ppma, 2 to 8 ppma Mg, 4 to 11 ppma Ti, 30 to 45 ppma Ga, and 0.2 to 0.7 ppma V. For the green to blue samples, Ga/Mg overlapped, varying from 5 to 30. Samples with a yellow bodycolor varied from 4 to 11. Other trace elements including Zr, Nb, Ta, W, Th, and U were also detected but in insignificant quantities. It is notable that Mg and Ti concentrations were comparable in the yellow samples (all Ti^{4+} charges compensate Mg^{2+}, leaving no Ti^{4+} to interact with Fe^{2+}), whereas Ti concentrations were significantly higher than Mg concentrations in the green to blue sapphires resulting in some Ti^{4+} forming Fe^{2+}-Ti^{4+} pairs (J.L. Emmett et al., "Beryllium diffusion of ruby and sapphire," Summer 2003 *G&G*, pp. 84–135). The chemical and UV-Vis-NIR spectroscopic features corresponded with the bodycolors of these sapphires. In addition, FTIR spectra of the gold sheen sapphires generally showed diagnostic features of AlO(OH), consistent with either boehmite or diaspore; kaolinite; and gibbsite.

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SYNTHETIC DIAMONDS

CVD Synthetic Diamond Over 5 Carats Identified

Chemical vapor deposition (CVD) technology has accelerated over the last several years, and the rapidly improving techniques have produced large, high-quality near-colorless and colorless synthetic diamonds. Two samples over 3 carats were reported in early 2016 as the largest CVD synthetics (Winter 2015 Lab Notes, pp. 437–439). GIA recently tested a CVD-grown synthetic diamond that weighed over 5 carats, marking a significant milestone.

The 5.19 ct cushion modified brilliant measuring 10.04 × 9.44 × 6.18 mm (figure 9) was submitted to GIA's Hong Kong laboratory for grading service. The stone was not disclosed as a synthetic diamond. Using the lab's standard screening and testing processes, it was identified as CVD synthetic. Following examination, a GIA Identification Report was issued and the stone was inscribed on the girdle with the report number and the words "Laboratory Grown," following GIA's protocols for undisclosed synthetics.

This is the largest CVD synthetic diamond GIA has examined to date, and the largest reported in the jewelry industry. It had J-equivalent color

Figure 9. This 5.19 ct CVD-grown diamond (10.04 × 9.44 × 6.18 mm, with J-equivalent color and VS_2-equivalent clarity) is the largest CVD synthetic GIA has identified to date.