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New Large Black Synthetic Moissanite as a Black Diamond Imitation

Two black, opaque, flat round gems were received at GGTL-Laboratories (Geneva, Switzerland) in October 2014 for certification as black diamonds (Figure 22). The samples weighed approximately 29 and 34 ct, and measured 28.0–28.3 × 3.7 mm and 29.2–29.5 × 4.0 mm, respectively.

Microscopic observation piqued our attention because the gems did not show features consistent with natural black diamond (i.e. an irregular distribution of brown-to-black inclusions of various shapes, dense clouds, etc.), heat-treated black diamond (minute graphite inclusions), or 'classic' black synthetic moissanite (very dark green-to-blue or brown body colour, etc.). Strong fibre-optic illumination revealed a dark grey body colour with an olive tinge (Figure 23), and reflected light showed a very fine-grained homogeneous texture (Figure 24-left). The microtexture was very similar to that of a black ceramic material (boron carbide) imitating black diamond that was described by Choudhary (2013; see Figure 24-right), but was different from the mosaic pattern in black synthetic moissanite described by Moe et al. (2013). Minute interstitial spaces in our samples measured 5–150 μm (mostly ~50 μm).

The two gems were inert to long- and short-wave UV radiation, but showed faint orange fluorescence when exposed to the intense 300–410 nm excitation of the GGTL DFI luminescence microscopy system. Their RI was over the limit

Figure 22: These large black diamond imitations (left, 29 ct and right, 34 ct) consist of very fine-grained synthetic moissanite. Photo by C. Caplan.

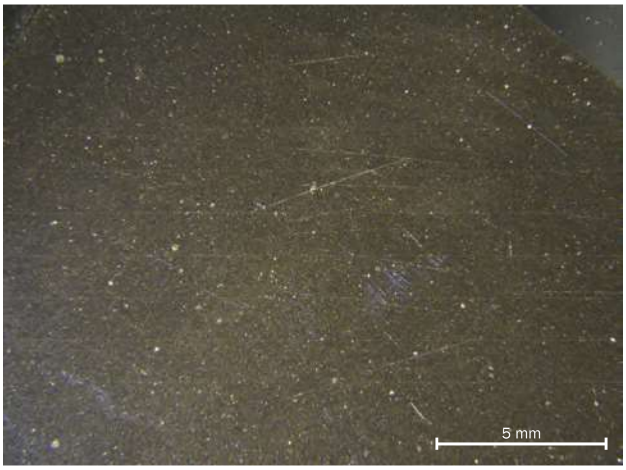


Figure 23: Viewed with the microscope and 250 W fibre-optic illumination, the synthetic moissanite samples showed a dark grey body colour with an olive tinge. Photomicrograph by F. Notari.

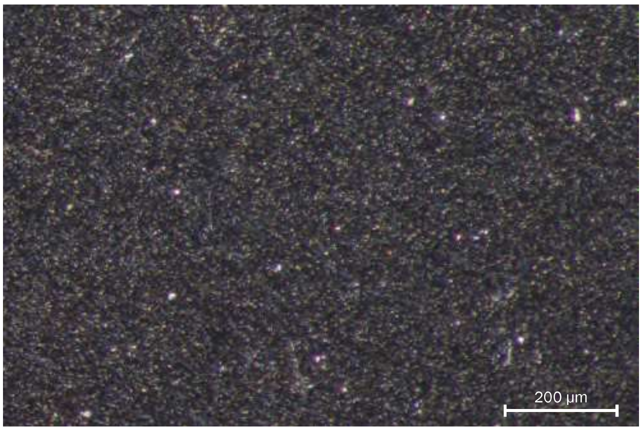


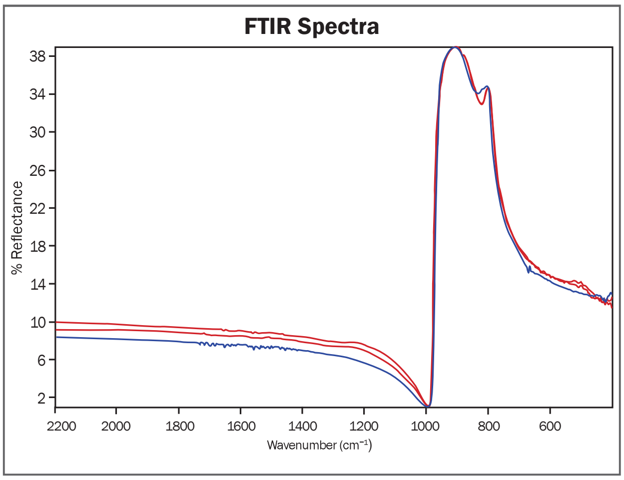
Figure 24: On the left, the 34 ct synthetic moissanite shows a very fine-grained homogeneous texture with minute reflecting particles. A similar texture is shown in the image on the right of a boron carbide black diamond imitation. Photomicrograph on the left by F. Notari, and on the right by Gagan Choudhary (magnified 48×; reprinted with permission from Choudhary, 2013).

of our refractometer (>1.81), and they tested positive for diamond with a thermal conductivity tester. The hydrostatic SG of the two samples was 3.16, and a hardness test showed >9 on the Mohs scale. (Hardness was tested with the client's permission on the girdle at 160× magnification.)

Specular reflectance FTIR spectra were recorded for both gems using a Thermo Nicolet Nexus spectrometer with a DTGS (deuterated triglycine sulphate) detector, by accumulating 20 scans at room temperature at a resolution of 4 cm^{-1}. The spectra showed features corresponding to a reference sample of green synthetic moissanite (Figure 25).

EDXRF chemical analysis was also performed on both gems, using a Thermo Noran QuanX-EC instrument with all available filters (count time of 300 s and beam diameter of 3.5 mm). The analyses showed major amounts of Si and traces of Fe, Cr and Ti. This is consistent with synthetic moissanite, which has a chemical formula of SiC (carbon cannot be detected by this instrument). The Fe, Cr and Ti are likely contained in the impurities that give the black appearance to this material.

Figure 25: The specular reflectance FTIR spectra of the two gems (red lines) provide a close match to the reference sample of green synthetic moissanite (blue line).



Our analyses indicate that these two gems are opaque black synthetic moissanite with a very fine-grained structure. The SG of 3.16 is helpful for its identification (compared to diamond's 3.54 and boron carbide's 2.40). Monocrystalline synthetic moissanite has a typical SG of 3.22, and the lower value obtained for these samples is probably due to their being some type of sintered product rather than a monocrystalline material. Such sintered dark grey synthetic moissanite is available for industrial applications (e.g. Saddow and Agarwal, 2004). Conclusive identification of this material as synthetic moissanite was shown by specular reflectance FTIR spectroscopy and EDXRF analysis.

This type of black synthetic moissanite is now clearly available in the market as large cut gems. In October 2014 we bought a sample weighing 210.65 ct (diameter ~41 mm) for comparison, and our observations and analyses of this gem were consistent with those described here.

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