Diamond Testers with a limited performance
不同鑽石測試儀 表現各有局限

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作者描述數種鑽石測試儀器在檢測和應用上的一些局限。

Introduction

Recently, a friend informed me that he had had a problem with a client when he sold him a blue diamond. The handy tool that identified this stone as "moissanite" was a Presidium Multi-Tester III (PMuT III) (Fig. 1). This should not happen! As I am on friendly terms with the producer in Singapore and also know about the worldwide distribution of the instrument I was keen to make my own observations. With a brand new PMuT III, I tested a handful of imitations and diamonds, colourless and coloured, natural and synthetic.

Fig. 1 Presidium Multi-Tester III

For many years there have been diamond testers on the market that base their identification on two features: thermal conductivity and IR-reflectivity and recently also electrical conductivity.

Thermotester: Among colourless minerals, diamonds are on the upper end of thermal conductivity. Diamonds are good conductors of heat. With this feature they distinguish themselves from all diamond imitations. A hot probe cools very quickly as the diamond absorbs the heat. The electricity that is needed to heat the probe to the programmed temperature is indicated on a scale. A strong amplitude thus indicates a diamond. But there is an exception: synthetic moissanite conducts heat almost as strongly. Due to this common characteristic the use of a thermotester becomes problematic as in both cases the thermotester result indicates "diamond".

Reflectometer: Diamonds possess a strong lustre. Reflectometers send an infrared beam onto the horizontally exposed table of the stone under test. The intensity of the reflected beam is measured and indicated on the device. While silicate and oxide minerals produce relatively low reflectivity values, diamond and synthetic moissanite are on the high end of the scale. If diamond is calibrated on a value of around 100, synthetic moissanite may reach 120 as it has a higher IR-reflectivity. In order to ensure that this method can operate reliably, the test stone must have a good polish and the surface of the exposed table must be clean. The first instrument to work using IR relative reflectivity was Dr William Hanneman's Jeweler's Eye in the 1970s.

Presidium diamond testers, produced in Singapore, are among the most frequently used instruments in the gemstone

trade. There are three types sold by the manufacturer: the Thermotester, the Duotester and the Multi-Tester III. They reached the market in that same order, which suggests an improvement in comfort and reliability from one to the next.

Presidium Thermotester: this is the most simple to operate of the three instruments. It measures thermal conductivity with the test probe and indicates whether the test stone is diamond or imitation. A handicap is that it does not differentiate between diamond and synthetic moissanite and thus fails to identify "moissanite".

Presidium Duotester: this combines the thermotester function with a reflectometer function. All stones identified as diamonds have to be tested with the reflectometer in order to identify synthetic Moissanite and thus distinguish them from diamond. The instrument (including the Presidium Reflectivity Meter) works irreproachably and recognises all diamonds, whether colourless, yellow, green, blue (type IIb) etc. (Figs. 2 & 3). But synthetic diamonds cannot be identified with this instrument because they have the same IR-reflectivity as natural diamonds.

Fig. 2 Duotester in thermotester mode identifies blue diamond correctly as "diamond"

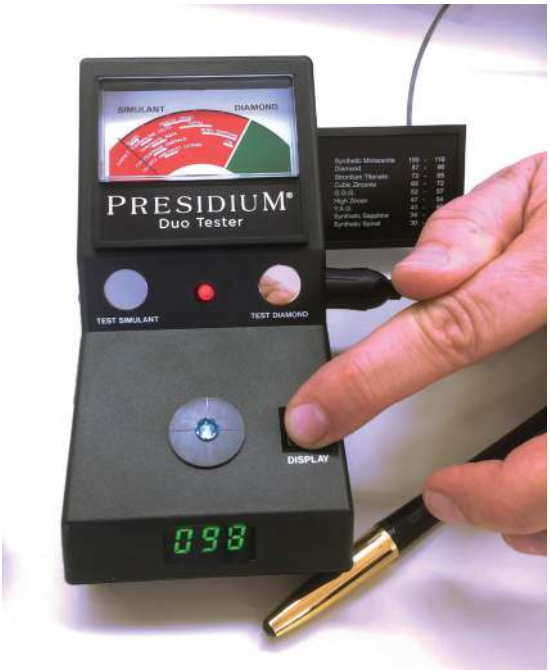

Fig. 3 Duotester in IR-reflectivity mode identifies blue diamond correctly as "diamond"

Presidium Multitester III: this has a different shape, is very handy and as small as a banana. On the tip there is a test probe and the test result is indicated on a luminescent diode scale with sections in different colours. On the upper end this is green and indicates "diamond" (green). The next lower section is for "moissanite" (yellow), followed by "imitations" (red). Testing requires a perpendicular contact of the probe with a clean table. This tester measures thermal conductivity and also electrical conductivity. The stone must be kept in or on metal for the test to function safely and the metal, either a ring or the metal test plate, must be hand-held so that everything is grounded. Mounted stones conduct via their mounting, loose stones conduct over the metal test plate. A measurement of IR-reflectivity is not supplied.

During our experiment for this report colourless synthetic Moissanite, type IIa, and blue type IIb diamonds were tested; the

latter a loose stone and in a gold setting. Both blue diamonds were wrongly identified as “moissanite” (Fig. 4).

Fig. 4 Presidium Multi-Tester III identifies blue diamond incorrectly by highlighting the yellow section for “Moissanite”

Conclusion: the most reliable instrument is the Duotester. Although the Multitester III is more handy and equipped with a luminescent scale, erroneous results are produced with blue diamonds (natural and synthetic). The reason for this is that blue diamonds are electrically conductive because of their Boron content. But synthetic moissanite is also electrically conductive. Therefore blue diamonds will also display as moissanite on the Multitester II. Furthermore, black diamonds with graphite in their fissures are also electrically conductive and they too are identified as “moissanite” using this instrument.

Unfortunately so far no mention of this restriction of the usefulness of the Multitester III has appeared in the user handbook. Neither was this limitation mentioned in an instrument evaluation (Linton et al., 2010).

Since these tests, however, the producer, Presidium of Singapore, has announced: “In relation to your suggestions, we have included the statements below, which you will now find in our online copies of our user handbook. For the physical copy of user handbook that comes along with the product please be assured the new revisions will shortly follow.”

Other diamond testers such as Diamond Pro, Diamond Wizard, RS Misar Diamonite Dual Tester, Culture III (JSP), A-Source, Ceres Dual Diamond Mate, etc. that are based on thermal and electrical conductivity without an IR-reflectivity measurement have not been tested by this author but may have the same restrictions.

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Reference

Linton, T., Johnstone, J. & Hunter, K. (2010): Presidium Multi Tester™ Instrument Evaluation Committee Report. The Australian Gemmologist, 3, 2010, p. 66-67