HUI PŌHAKU 'O HAWAI'I
Rock & Mineral Society of Hawai'i, Inc.

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DIAMONDS AND DIAMOND SIMULANTS

This month's topic was originally "Jewelry." However, this topic is virtually impossible to write a short 3-4 page article about. Therefore we have a little compromise. This month's emphasis will be on Diamonds, and Diamond simulants.

Diamonds are just about the last industry where one can purchase a natural gemstone with confidence. Granted there are treatments and enhancements, however these are usually explicitly prohibited. There are specialists in fancy (natural) color diamonds who will not buy or sell stones known to have been irradiated, although these stones have been marketed for more than 50 years. As a result, irradiated diamonds are pretty much segregated from the mainstream and are sold exclusively by a tiny number of dealer-devotees.

This is ironic because diamonds were the first gem to be colorized in the lab with radiation. In 1904, British scientist Sir William Crookes proved that Diamonds could have their color changed by burying small stones in radium bromide salts.

Crookes' methods succeeded, however it left something to be desired since diamonds turned green on the surface only. Furthermore not only did it take months to accomplish, but it also became radioactive in the process (some of them are still radioactive). In 1942 stones were greened more than superficially over days in a Michigan cyclotron without becoming radioactive for more than a few hours afterward, thus a stage was set to color diamonds in a safe, fast, permanent way. By coupling irradiation and heating, research gemologists began producing green, blue, yellow, brown and black diamonds on a commercial scale in the early 1950s.

YAG - Yttrium Aluminium Garnet

MEETING
Wednesday
April 23, 2008
7:00—9:00 pm
Makiki District Park
"Diamonds"

NEXT MONTH
Wednesday
May 28, 2008
"Tourquoise"

LAPIDARY
Classes on Thursday Evenings
7:00—9:00 pm

MEMBERSHIP COSTS 2008

Single: $10.00
Family: $15.00

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The irradiation process produces just about every diamond hue found in nature, however it does so with varying degrees of success. Natural and treated golden brownish-yellow stones (possessing a color that dealers call "burnt orange") can't be told apart merely by sight.

In 1992, some unscrupulous dealers took to submitting borderline "fancy-intense" stones to GIA which they gambled would eke out that grade. Those that did had been zapped to deepen color and heighten value, then offered for sale as top-notch all-natural yellows. Luckily, labs caught their artificial coloring. Recent scams involving undisclosed irradiation of yellow and also green diamonds recall the most famous diamond scandal of modern times involving a mammoth natural yellow stone called the "Deepdene," whose color was deepened several shades by irradiation without disclosure of this fact. In 1971, this 104.52-carat stone was sold by Christie's Geneva for about $1.2 million. Although the stone's color was pedigreed of natural origin, spectroscopic examination showed a telltale 5940 absorption line—proof of irradiation since its discovery by GIA's Robert Crowningshield in 1956.

Why did the stone's consignor fail to reveal the treatment? "At the time," Crowningshield explained, "many believed that color in diamonds was due to radiation. So putting stones in a cyclotron, it was argued, did what nature would have done anyway. Today, we know yellow in diamonds is caused by nitrogen."

Anyhow, the nearly identical color of natural and irradiated yellow diamonds makes a good case for the latter, especially after factoring in the enormous price differences between the two. As result of this, the Deepdene is the largest irradiated Diamond in existence.

The majority of commercially available synthetic diamonds are yellow in color and produced by so called High Pressure High Temperature (HPHT) processes. The yellow color is caused by nitrogen impurities. Other colors may also be reproduced such as blue, green or pink which are a result of the addition of boron or from irradiation after synthesis.

In the case of synthetic diamonds, for example, depending on the method of production (either high-pressure/high-temperature [HPHT] or chemical vapor deposition [CVD]) and the color of the diamond (colored, D-Z color range or D-J color range), several methods of identification can be attempted by a gemologist or gemlab. CVD diamonds can usually be identified by an orange fluorescence, D-J colored diamonds can be screened through the Swiss Gemological Organization's (SSEF) Diamond Spotter, and stones in the D-Z color range can be examined through the DiamondSure UV/visible spectrometer which is a tool developed by De Beers. are not seen in synthetic diamonds.

High concentrated 2 inch Er-YAG crystal

YAG-Co single crystal

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High Pressure High Temperature Treatment (HPHT) was first used to turn yellowish diamonds into fancy colored diamonds, now it is also used to transform some unpopular brownish diamonds into more expensive colorless diamonds. Some companies claim HPHT isn't a treatment at all, calling it a technique that finishes the job nature started. That attitude, and the fact that the process is difficult to detect, has made HPHT a controversial topic.

Gemological Institute of America (GIA) grading reports now indicate when HTPT treatments are detected by stating "HPHT Annealed" or "Artificially Irradiated" in the Origins portion of a report. Only diamonds that are laser-inscribed with the words "HPHT PROCESSED," "IRRADIATED," or under a specific registered name are graded.

A Diamond simulant is defined as a non-diamond material that is used to simulate the appearance of a diamond. Diamond-simulant gems are often referred to as diamante.

The distinction between a synthetic diamond (man-made diamond consisting of carbon atoms arranged in the typical diamond structure) and a diamond simulant (not a carbon compound with the diamond structure) is very important. Some of the Diamond Simulants are:

Strontium Titanate is an oxide of Strontium and Titanium. It was long thought to be a wholly artificial material, until 1982 when its natural counterpart—discovered in Siberia and named Tausonite. Tausonite remains an extremely rare mineral in nature, occurring as very tiny crystals. Its most important application has been in its synthesized form wherein it is occasionally encountered as a diamond simulant.

The name tausonite was given in honour of Lev Vladimirovich Tauson (1917-1989), a Russian geochemist. Disused trade names for the synthetic product include strontium mesotitanate, Fabulite, Diagem, and Marvelite.

Synthetics are usually transparent and colourless, but can be doped with certain rare earth or transition metals to give reds, yellows, browns, and blues. Natural tausonite is usually translucent to opaque, in shades of reddish brown, dark red, or grey. Both have an adamantine (diamond-like) luster. Strontium titanate is considered extremely brittle.

Yttrium Aluminum Garnet (YAG), a modern diamond stimulant, discovered in 1828 by Friedrich Wohler. It was used as an alternative to Sapphire as an optical material Yttrium aluminium garnet (YAG, $Y_3Al_5O_{12}$) is a synthetic crystaline material of the garnet group. YAG is commonly used as a host material in various solid state lasers. However, YAG for a period was used in jewelry as a diamond and other gemstone stimulant

Strontium Titanate (Fabulite)

Colored variants and their doping elements include: green (Chromium), blue (Cobalt), red (Manganese), yellow (Titanium), purple (Neodymium), pink, and orange. As faceted gems they are valued (as synthetics) for their clarity, durability, high refractive index and dispersion.

As a synthetic gemstone, YAG has numerous varietal and trade names : alexite, amamite, circolite, dia-bud, diamite, diamogem, diamonair, diamone, diamonique, diamonite, diamonte, di'yag, geminair, gemonair, kimberly, Linde simulated diamond, nier-gem, regalair, replique, somerset, triamond, YAIG, and yttrium garnet.

Cubic zirconia (or CZ), the cubic crystalline form of ziconium dioxide, is a
mineral that is widely synthesized for use as a diamond simulant. The synthesized material is hard, optically flawless and usually colorless, but may be made in a variety of different colors. It should not be confused with zircon, which is a zirconium silicate. Cubic zirconia is extremely rare in nature.
Because of its low cost, durability, and close visual likeness to diamond, synthetic cubic zirconia has remained the most gemologically and economically important diamond simulant since 1976.

Cubic zirconia has a hardness ranging from 8.5 – 9.0. The refractive index of CZ ranges from 2.15 - 2.18, compared to 2.42 for genuine diamond.

Moissanite is a new product, but its origins go back to 1893 when Dr. Henri Moissan, a French chemist and later a Nobel Prize winner, identified minute quantities of natural silicon carbide, known as Lusenite, in the Diablo Canyon meteorite found in a remote area of Arizona. Recently, these elements were replicated in a synthetic material to produce a synthetic gemstone with similar properties to diamond. The gemstone is more brilliant than diamond, Refractive Index 2.65-2.69, has a higher lustre than diamond at 20.4%, and a hardness of 9.25, diamond being 10. Relative Density: 3.21. Moissanite replicates a diamond so well, that it could be sold as a diamond to the unwary buyer.

Moissanite is most convincing as a diamond substitute in small sizes. Larger stones still show slight greenish or grayish tones that are difficult to eliminate. Careful examination through the crown facets (not through the table, since that's oriented on the optic axis) under a loupe or microscope should easily reveal facet doubling caused by double refraction, as well as very non-diamondlike surface polish and inclusions.

GGG-Nd single crystal (2 inch in diame-

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DOOR PRIZES

Please note that we have instituted door prize drawings at our monthly meetings. Because of Hawaii's gambling laws, these drawings cannot be conducted in the common "raffle" format where tickets are sold. Rather, each *paid* member attending the meeting will receive a drawing ticket upon request. A voluntary donation of $1.00 is requested and encouraged. Drawings will be conducted at the end of the meeting with available prizes awarded in random order. You must be present to win. Please remember: if you win a prize, please bring one to the next meeting. This helps to keep our drawings going. Thank you.

MAHALO!

Many mahalos to everyone who came to our Christmas Potluck! The food was second only to the conversations. Special thanks to those who participated in the gift exchange. We certainly 'rocked' around the Christmas tree this year! Here is to a successful and prosperous 2008!

Cubic Zirconia

NEWSLETTER COMMENTS? SUGGESTIONS?

I am hoping to 'freshen up' the newsletter a bit., and would love your input! If there is anything that you would like to be added, taken away or changed around, please email me at elise.thomasson@gmail.com All comments would be appreciated.

Rock & Mineral Society of Hawai`i, Inc.

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The Rock & Mineral Society meets on the 4th Wednesday of each month (except for adjusted dates in November and December) at the Makiki District Park, 7:00 - 9:00 pm. Enter from Keeaumoku Street. Parking is free but limited.

The Newsletter is published monthly, a week prior to the meetings and is distributed in electronic format by email (Adobe Acrobat PDF file attachment). Printed copies are "snail" mailed to those who do not have email. The electronic format usually contains full-color images; the print version may be limited to B&W due to reproduction costs.

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