

HPHT and CVD Laboratory-grown Diamonds. What's the difference?

By Kaylan Khourie, FGA

Gem-quality laboratory-grown diamonds have become fairly popular as an option for jewellery in the past few years and have recently become more available in South Africa. This is probably due to the lower prices and wider availability – due to large factories¹ constantly growing many diamonds in all shapes, sizes and colours² – compared to natural diamonds. Originally the HPHT growth method was the preferred choice for manufacturers but CVD-grown diamonds seem to be more common due to the faster growth rate – reportedly greater than 50µm/hour³, better clarity outcome and the ability to grow many diamonds in one growth chamber.

When purchasing a laboratory-grown diamond, is it important for you to know the growth method?

Both HPHT and CVD-grown diamonds have the same physical and optical properties and are both still composed of carbon – just as natural diamonds are. Therefore, in the jewellery trade there is no reason that a HPHT-grown diamond should be favoured over a CVD-grown diamond, or vice-versa. However, distinction between natural and laboratory-grown diamond is essential to maintaining consumer confidence across all markets. Here is some brief interesting information regarding the two different growth methods:



Fig 1: Blue HPHT rough crystal from Algodanza. Image courtesy of B. Deljanin and D. Simic⁵

HPHT

“HPHT” stands for “High Pressure High Temperature” and represents the environment used to grow the diamond.

A diamond (either natural or laboratory-grown) seed plate is used as a starting point and is placed inside a chamber containing pure carbon powder that gets dissolved in a molten metal flux mixture. A catalyst – usually either nickel (Ni), cobalt (Co) or iron (Fe) – is incorporated into this flux mixture to speed up the growth process. The chamber is then subjected to extreme temperature and pressure (up to 1700°C and 6.5 GPa). As the mixture cools down, the carbon crystallises onto a seed plate within the chamber and the diamond begins to grow.

CVD

“CVD” stands for “Chemical Vapour Deposition” and describes the process used to grow the diamond.

As with the HPHT method, diamond seed plates are used as a starting point – usually numerous seed plates are used at once. They are placed on top of a platinum base, inside a vacuum chamber. A carbon and hydrogen gas (usually methane) is inserted into the chamber and then, at a low pressure and high temperature, irradiated by microwaves that then form a plasma cloud on top of the seed plates. Carbon is separated from the gas and deposited onto the seed plates and the diamonds begin to grow. ■

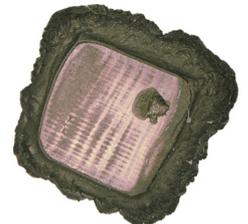


Fig 2: CVD rough crystal with carbonaceous inclusions. Image courtesy of Taijin Lu

References

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⁴Khourie, K. 2018. What are Synthetic Diamonds?. December Ed. of SA Jewellery News, pp. 18-19.

⁵Authors of the book: Laboratory-grown Diamonds (2020). <https://bit.ly/38WfTY1>

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