HRD Antwerp – Research Newsletter

March 2010

Scientific Diamond News

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Scientific Events

Scientific conferences related to diamond and precious stones:

4th International Conference on New Diamond and Nano Carbons (NDNC 2010), May 16-20, 2010, Suzhou, China. More details: http://ndnc2010.0431cn.com

2nd International Workshop on Science and Applications of Nanoscale Diamond Materials, June 28 - July 2, 2010, Zakopane, Poland. Jointly with **5th Wide Bandgap Materials** and **7th Diamond & Related Films** International Conferences. More details: http://www.wbm.p.lodz.pl

De Beers Diamond Conference, July 13-16, 2010, University of Warwick, UK (invitation only)

Diamond 2010 - 21st European Conference on Diamond, Diamond-like Materials, Carbon Nanotubes and Nitrides, September 5 - 9, 2010, Budapest, Hungary. More details: http://www.diamond-conference.elsevier.com

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Scientific Diamond News

Pitfalls in automatic diamond colour grading

Automatic colour grading of diamonds is becoming increasingly important to the diamond business, due to its ability to save time and bypass the possibility of human error.
However, systematic grading errors, due to the use of low-quality colour grading machines, have been reported.
A recent issue of Antwerp Facets Online addresses this topical subject. **(read more)**

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Fluorescence Cage: a new way to identify HPHT treated diamonds?

Recently, claims were made that a new method had been developed to identify HPHT treated diamonds. Its simplicity aroused a lot of interest. It was claimed that, under UV fluorescent lighting, the facet edges of some HPHT treated polished diamonds could be seen to light up, effectively creating a "cage" around the stone (https://www.diamondintelligence.com/magazine/magazine.aspx?id=7821 and Gems & Gemology, Fall 2009, p. 186-190).
HRD scientists found that this phenomenon was absent in a large number of HPHT treated reference stones, consistent with subsequent reports in the literature, where it was claimed that fluorescence cage luminescence is not characteristic of HPHT treated diamonds (Gems & Gemology, Winter 2009,p. 235).

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"Nanocut" diamonds: increasing the fire.

Scientists at the California Institute of Technology (Caltech) have developed a new technique to increase the dispersion of colour ("fire") seen in a diamond. Essentially, the method is based on plasma etching diffracton gratings on the facets of the stone. Parallel lines are etched, at distances of approximately 1 micrometer. This produces "rainbow" colours, similar to what is seen on the surface of a Compact Disc. The method was first announced online:
http://www.gia.edu/research-resources/news-from-research/Nanocut-diamonds.pdf

More details can be found in Gems & Gemology, Winter 2009, p. 260 – 270.

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CVD coated gem diamond.

The (apparent) colour of a diamond can be changed by coating the stone with a layer of a coloured substance. Usually the coating consists of a foreign material that can be removed easily, mechanically or chemically. However, recently HRD researchers have described a stone that had been coated with a blue layer of CVD synthetic diamond. This work was presented at the Hasselt Diamond Workshop 2010, SBDD XV, February 22-24, 2010, Hasselt, Belgium (http://www.imo.uhasselt.be/SBDD2010)
Below you can find the abstract of this contribution:

Characteristics of a fancy colour CVD coated natural gem diamond

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One of oldest techniques to enhance the apparent colour of a polished gem diamond is the application of coatings. The principle of a coating is relatively simple. A thin layer of foreign material is applied to part or all of a gemstone's surface in order to change its colour appearance. Coatings are used to change the colour to a fancy, desirable colour or to mask the underlying bulk colour (i.e. to change the colour from yellowish to more colourless). For centuries, various forms

of coating, dyeing or paintings have been used. More recently, new and more advanced fancy colour coatings have appeared on the gem diamond market (2 types: SiO_2 and CaF_2 coatings). These types of coated gem diamond are commercially available. The thin layer (~ tens of a nm) of non-diamond material can be damaged or removed by a scratch test, by the use of pumice/corundum powder or by (deep) boiling in sulphuric acid. The key message is that these coatings are non-permanent and can be detected by microscopic identification, UV VIS and IR spectroscopy, EDXRF and SEM. The gemmological, spectroscopic and chemical characteristics of these coatings have been described in literature [1, 2].

In the current paper we would like to draw attention to another type of coating: the CVD diamond coating. There have been significant advances in CVD diamond synthesis in the last decades. Numerous developments have led to the production of large-area CVD diamond thin films of high crystalline quality [3, 4]. Taking into account this progress in CVD diamond synthesis one could consider the application of a thin high-quality CVD diamond coating on gem diamond in order to change its apparent colour.

The current paper shows the results of an in-depth analysis using several standard and more advanced techniques. The gemmological, spectroscopic and chemical characteristics of this CVD coated gem diamond are discussed. For characterisation, optical microscopy (DIC and D-Scope), IR, UV VIS and PL-Raman spectroscopy are used. In addition, SEM-EDX and EDXRF are used for chemical analysis and high resolution imaging down to nanoscale.

Although the quality of this particular diamond is far from excellent and telltale indications appear readily during examination, this example does illustrate the potential of the CVD diamond deposition technique in the area of diamond colour treatment. Therefore HRD Antwerp will remain committed to invest in detection methods to identify these and other types of colour treatments.

Acknowledgements
HRD Antwerp is grateful to Gemmologisch Gilde Nederland for providing the opportunity to study this CVD coated gem diamond.

References:
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[3] P. M. Martineau, M. P. Gaukroger, K. B. Guy, S. L. Lawson, D. J. Twitchen, I. Friel, J. O. Hansen, G. C. Summerton, T. P. G. Addison, and R. Burns, *High crystalline quality single crystal chemical vapour deposition diamond*, Journal of Physics: Condensed Matter 21 364205 (2009).
[4] Q. Liang, C. S. Yan, Y. Meng, J. Lai, S. Krasnicki, H. K. Mao, and R. J. Hemley, *Recent advances in high-growth rate single crystal CVD diamond*, Diamond and Related Materials, Vol. 18, Issues 5-8, pp 698-703 (2009).

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