Hydrogen Rich Treated Black Diamonds

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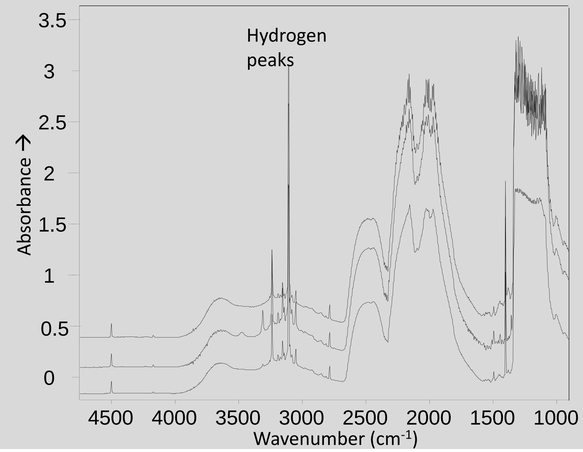
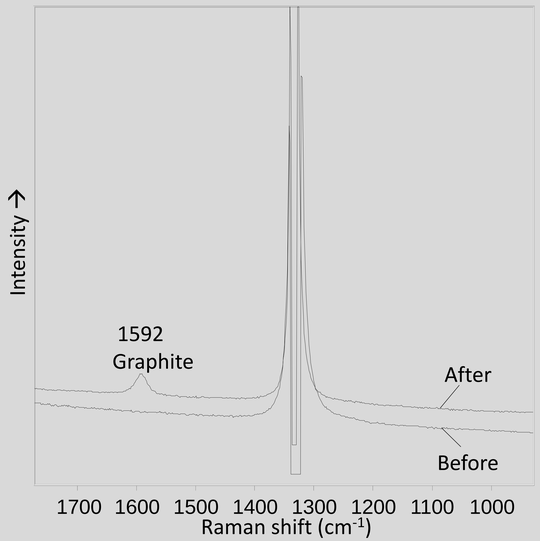
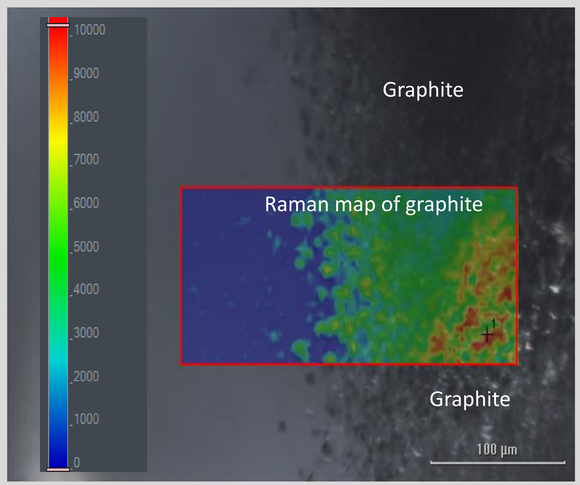
Black diamonds with poor transparency due to an intensity of mineral inclusions and fractures are routinely traded the gem market today. Although the inclusions and fractures are of a natural origin this type of diamond is often heated to create a more uniform color by further graphitizing these inclusions. After nitrogen hydrogen is the most common impurity in diamond and is often responsible for a gem quality diamonds color (see right). Recently GIA laboratories have seen large volumes of "black" faceted diamonds for identification. These diamonds are hydrogen rich(box 1) and it is suspected that this material is treated. Three faceted hydrogen rich diamonds (see above) have been documented and heated.
A black color identical to that of the submitted diamonds has been achieved.
The diamonds were heated to 1500 °C for 5 minutes in a vacuum, no surface graphitization occurred.



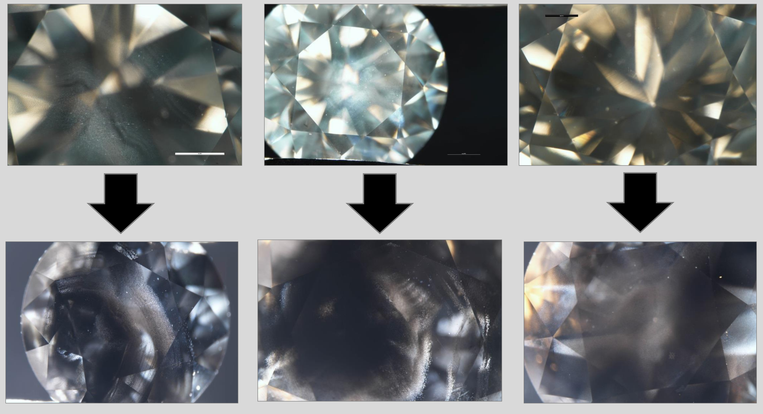
Mid-FTIR spectra of three type Ia diamonds, showing hydrogen related peaks in the three phonon absorption region.

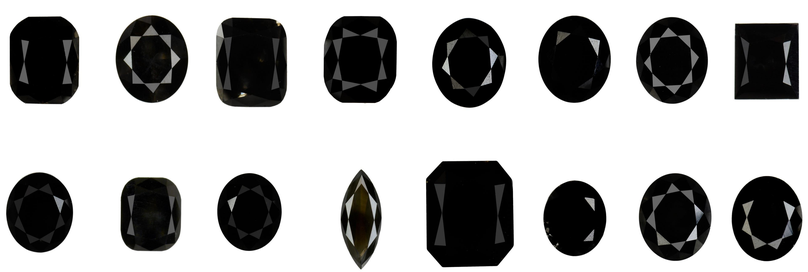




Raman mapping of graphite can be useful. Raman maps where made before and after heating (see above) after heating graphite can be detected (graphite peak at 1592 cm-1). It can be observed in the above map that graphite is detected in areas of dense cloud.
It is possible that graphite is present before heating but these graphite particles are so small they are not detected with the spatial resolution (100x) available. After heating the size of the graphite particles may have increased.
Observing the G-band (graphite) in these samples and obtaining Raman map data may be a very useful identification criteria.

Seen to the right are micro-images taken before and after heating . Visual observations are the most important identification feature. The before images (top) show the dense hydrogen clouds causing the grayish to brownish (green in some cases) color .
The after images (bottom) show the graphitized hydrogen clouds now denser and creating a uniform black color throughout the diamonds. Now graded as "Fancy Black" on GIA's color grading system. Therefore this evenly distributed black color is suspicious in this type of diamond.





Seen to the left are 16 representative examples of faceted black diamonds submitted to GIA for identification (ranging from 0.45 to 3 carats).
GIA is now able to determine the origin of these diamonds as "Treated" (heated), based on the results of this research. A uniform black color identical to that of these diamonds (left) has been achieved.
More samples have been obtained and further heating experiments are being conducted.