GIT GEMSTONE UPDATE

"Blue Sapphire Undergone High Pressure High Temperature Enhancement"

GIT-Gem Testing Laboratory (GTL)

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During the 4th GIT International Gem and Jewelry Conference held at Chiangmai on 9-11 December 2014, Hanmi Gemological Institute & Laboratory (GIG), our allied gemological laboratory from Korea, reported about a new blue sapphire treated at high pressure and high temperature by using HPHT apparatus (**click to see Choi et al., 2014a, see also Choi et al., 2014b**). Evidently, the HPHT apparatus is very well known in diamond industry for decades. This apparatus invented for the synthesis and treatment of diamond. It, however, has not been used outside the diamond industry before. Until recently, a Korean company was reportedly the first group of re-searchers to apply the HPHT apparatus for the treatment of corundum. After some modification of the apparatus and many trial-and-error attempts of treatment conditions, they claimed that they were able to turn pale blue sapphire into more intense and saturated hue by such treatment.

Up-to-date information confirmed that starting materials treated by this technique were pale blue sapphires from Sri Lanka (Sun-Ki Kim, per. Comm., and Choi et al., 2015). This method intended to use for the improvement of a certain quality of untreated stone as well as those that could not successfully be treated with traditional heating. For the enhancement process, there was no addition of any chemical element except a small quantity of water (Hyunmin Choi, per. Comm.). Even though, Song et al. (2015) revealed their experimental condition (i.e., P @ 1 GPa and T @ 1700-1800°C for 5 minutes), the Korean company who used the HPHT process has not yet disclosed its detailed enhancement procedure. This treatment, nonetheless, has not applied to other varieties of corundum yet (Sun-Ki Kim, per. comm.). The finish products have already entered the gem market a few years earlier. It is, therefore, our intention to update information about this particular type of blue sapphire that came across by our Laboratory.

Since 2013, we have examined over 40 blue sapphires that were doubtful of HPHT enhancement from our customers (see Figure 1 as an example). Those sapphires showed the presence of a unique strong absorption band centered around 3040-3050 cm^{-1} on the IR spectrum (see Figure 2) that was reportedly found in blue sapphire after HPHT treatment (Choi et al., 2014a&b). Their general appearance, basic gemological properties, microscopic features, trace element chemistry as well as UV-Vis spectra were rather similar to those found in simply heated sapphire. Surprisingly, however, another group of Korean researchers' reportedly did not find the broad absorption band at 3040-3050 cm^{-1} in the FTIR spectra of blue sapphires after enhancement by HPHT process (Song et al., 2015). Nonetheless, by applying HPHT treatment, it may actually help avoid severe internal

tension cracks due to differential thermal expansion of solid inclusions and fluid inclusions in host corundum as well as help minimize thermal decomposition of some mineral inclusions, which may cause critical damage to the stone.

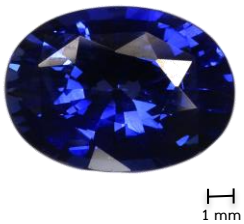

Figure 1: A 3.67 ct blue sapphire submitted to GIT-GTL for testing

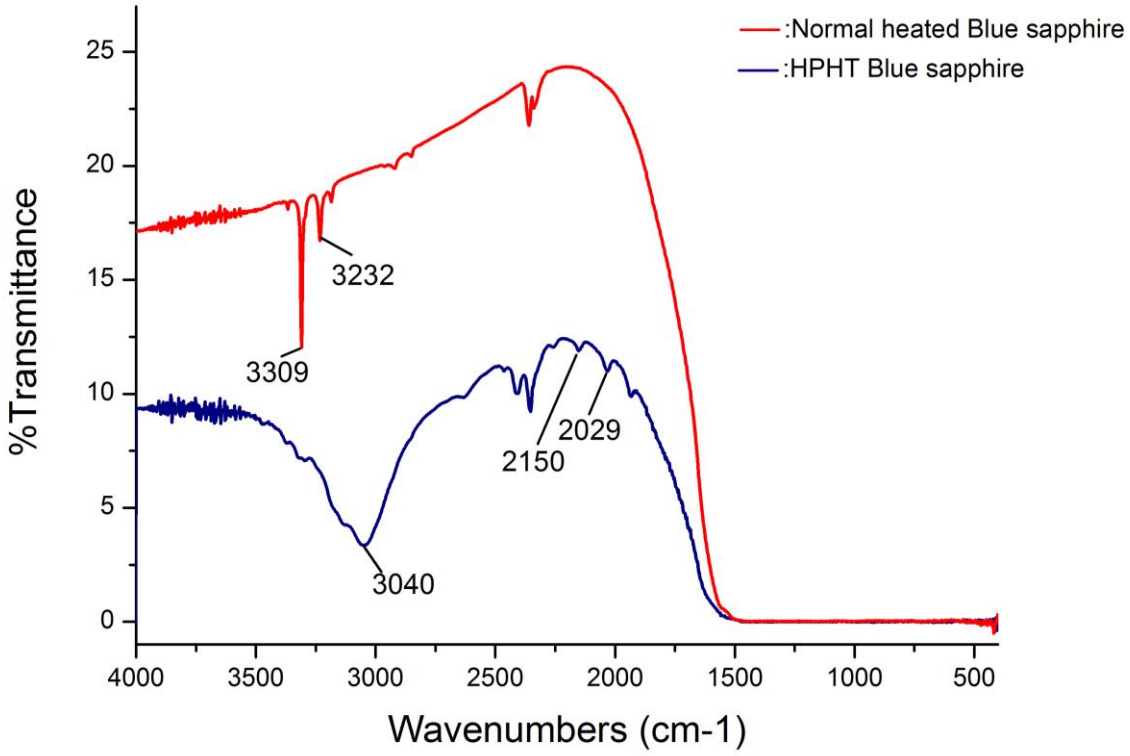

Figure 2: Typical FTIR spectrum of the blue sapphires showing strong absorption band centered at 3040 cm^{-1} with shoulder peak at 2627 cm^{-1} and smaller side peaks at 2630, 2150, 2029 and 1934 cm^{-1} (blue line) as compared to that of the normal heated stone (red line).

Based on the evidences described above (i.e., the presences of diagnostic broad absorption bands centered around 3040-3050 cm^{-1} on the IR spectrum and somewhat peculiar inclusion features), GIT-GTL, from now on until further notification, will issue our gem identification report for any blue sapphires that are suspicious of HPHT enhancement in our testing result as follows:

Species : **Natural Corundum**
Variety: **Blue Sapphire**
Comment(s): **Gemological evidences suggest enhancement by High Pressure High Temperature process**

Further detailed study on this treatment and how to identify the treated stones more precisely are underway with close collaboration research between GIT and Hanmi Gemological Institute & Laboratory (GIG) (South Korea). A series of technical papers regarding this treatment intent to be published in an international gemological journal.

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