



RAMAN ANALYSIS REPORT
22 Dec 2009

JOB NUMBER C09ZD284
PO NUMBER Credit Card

for

Less Wright
BetterThanDiamond, Inc.
BetterThan.com
1605 NW Sammamish Road
Issaquah, WA 98027

Prepared by:

Vasil Pajcini, Ph.D.
Sr. Scientist, Raman Services
(Tel. 408-530-3852; vpajcini@eaglabs.com)

Reviewed by:

Angela Craig, Ph.D.
Manager, FTIR, Raman, GC-MS Services
(Tel. 408-530-3642; acraig@eaglabs.com)

RAMAN ANALYSIS REPORT

Requester:	Less Wright
Job Number:	C09ZD284
Analysis Date:	22 Dec 2009

Purpose:

To verify the presence of a sapphire (corundum) coating on a gem identified as “Diamond Nexus Labs” (DNL) and to determine that the gem was cubic zirconia (CZ).

Summary:

Raman spectroscopy did not detect the presence of sapphire (corundum, Al_2O_3) on the “Diamond Nexus Labs” gem, which was indeed cubic zirconia (CZ).

Experimental:

The measurements were performed using a “LabRam” J-Y Spectrometer. An Ar^+ ion laser (514.5 nm wavelength) and an 1800 gr/mm grating were used in the measurements, which were repeated with a HeNe laser (632.8 nm wavelength) and a 600 gr/mm grating. The measurements were performed using backscattering geometry (180°) under an Olympus BX40 microscope.

Results and Discussion:

[Spectrum 1](#) is a Raman reference spectrum of corundum (sapphire, Al_2O_3). The strongest peak is located at 416 cm^{-1} . Thus, if the gem is coated with corundum, we would expect to see a Raman peak at 416 cm^{-1} , no matter how weak this peak will be, even in the case of a thin coating.

A Raman spectrum acquired with the 514.5 nm wavelength from the top face of the “Diamond Nexus Labs” (DNL) gem is shown as [Spectrum 2](#). The main peak $\sim 600\text{ cm}^{-1}$ demonstrates that the gem is CZ. However no sharp peaks due to corundum were detected in [Spectrum 2](#). Not even a weak signal attributable to the strongest peak of corundum at $\sim 416\text{ cm}^{-1}$ was seen in [Spectrum 2](#), which is compared with the Raman spectrum of corundum in [Spectrum 3](#). The same results were observed in other spectra run at different locations on the gem surface (Spectra [4](#) and [5](#)).

Next a Raman spectrum was acquired with the 514.5 nm wavelength from another gem called “White CZ” ([Spectrum 6](#)). [Spectrum 6](#) of “White CZ” is compared with [Spectrum 2](#) of the “Diamond Nexus Labs” in [Spectrum 7](#). Both gems have very similar bands (some of which are not Raman signals but rather luminescence bands) with slightly different intensities in the bands below 600 cm^{-1} . This difference might be due to the fact that the gems are composed of slightly different CZ or possibly due to the presence of a thin coating. Note that such a coating, if present could not be verified to be corundum, may have been applied on the “Diamond Nexus Labs” gem. However both gems were clearly CZ since they matched a reference

spectrum of CZ ([Spectrum 8](#)) and not diamond, a reference spectrum of which is shown as [Spectrum 9](#).

Natural corundum usually contains traces of Cr, which produces strong luminescence doublet peaks at 693 and 694 nm, while the Raman shifts are at 1379 and 1398 cm^{-1} , if the spectra are acquired with a HeNe laser (632.8nm wavelength). [Spectrum 10](#) was acquired with the HeNe laser from a sapphire sample.

[Spectrum 11](#) was acquired with the HeNe laser from the DNL gem. The DNL gem did not show any luminescent peaks due to traces of Cr present in corundum. [Spectrum 11](#) is overlaid with the sapphire spectrum in [Spectrum 12](#). This result confirms that no corundum (natural Al_2O_3) was present in the coating of the DNL gem.

A Raman spectrum from the "White CZ" with the HeNe laser is shown as [Spectrum 13](#). Both Raman spectra from the CZ gems: DNL gem and "White CZ" gem are compared in [Spectrum 14](#). They are very similar CZ gems.

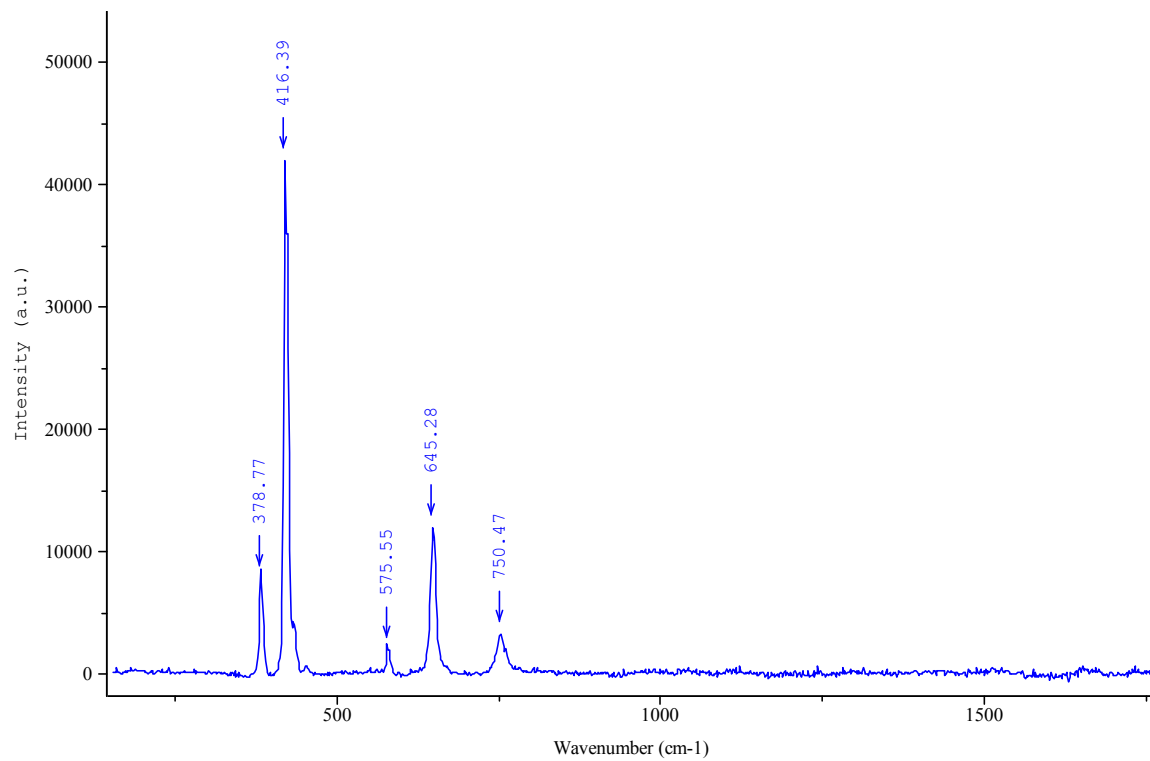
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<http://www.eaglabs.com/evaluate.htm?job=C09ZD284Ra>

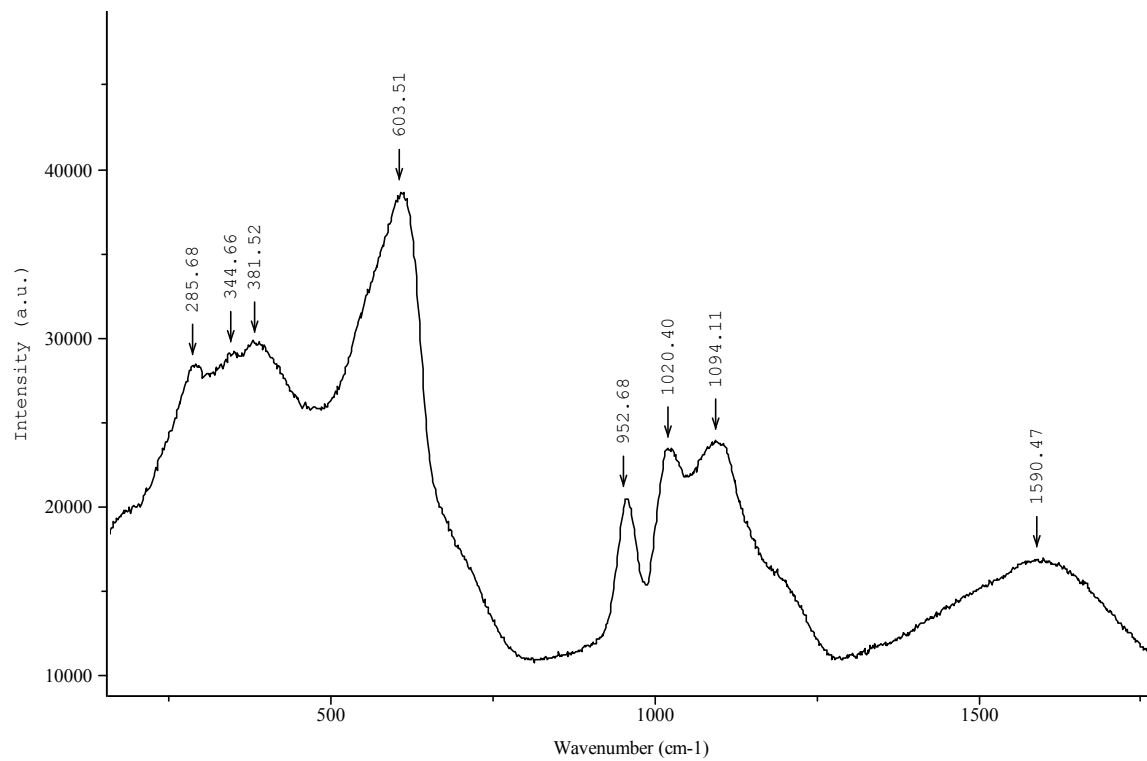
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Appendix 1

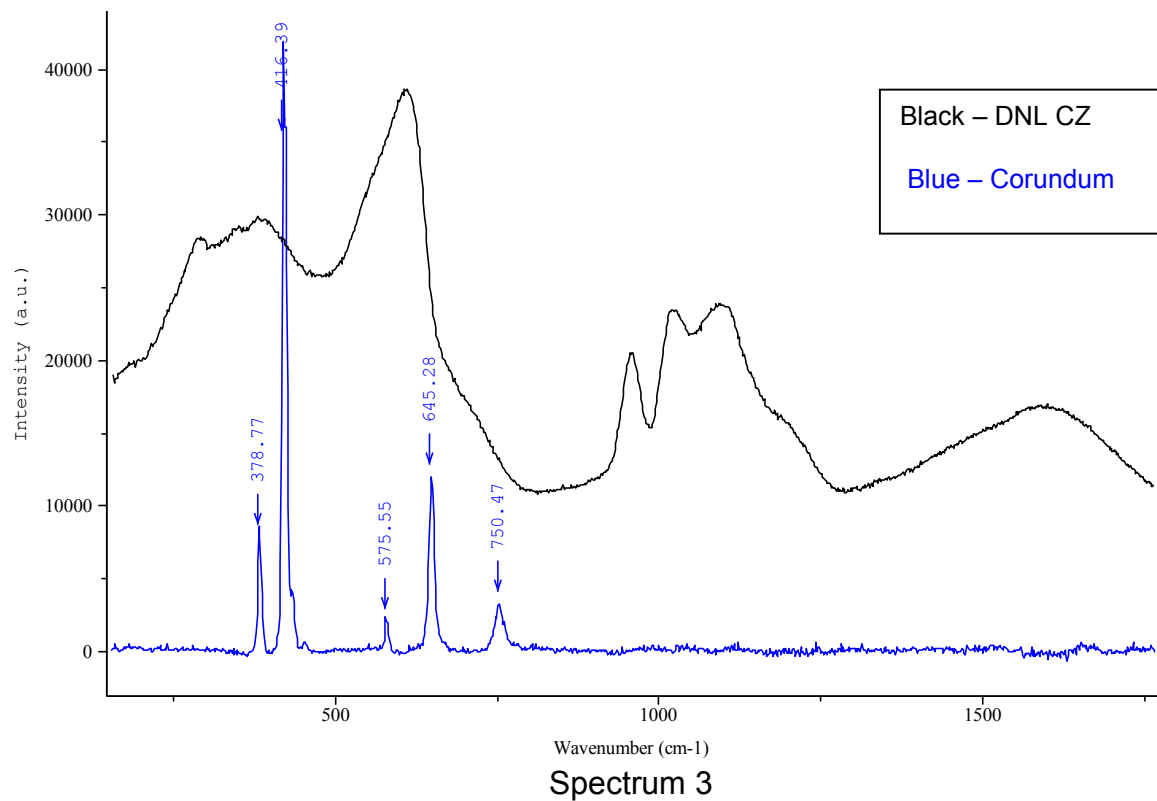
Raman spectroscopy is the collection of light inelastically scattered by a material or compound. When a light of known wavelength strikes a material, the light is shifted according to the chemical functionalities of the material. The intensity of this shifted light depends on both molecular structure and macrostructure. As a result of these phenomena, the collection of the shifted light gives a Raman spectrum that can provide direct information regarding the molecular vibrations of the compound or material. We can then interpret this information to determine chemical structure, organization, and in some cases, non-covalent intermolecular interactions.

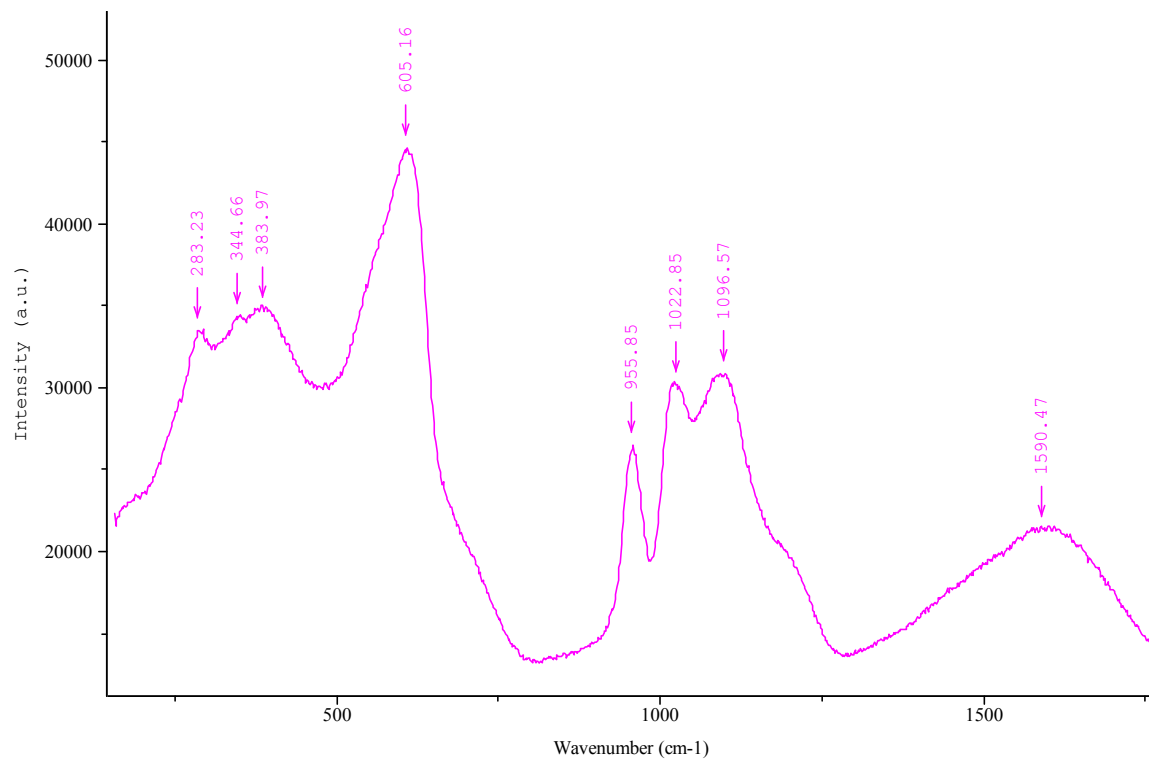


Spectrum 1

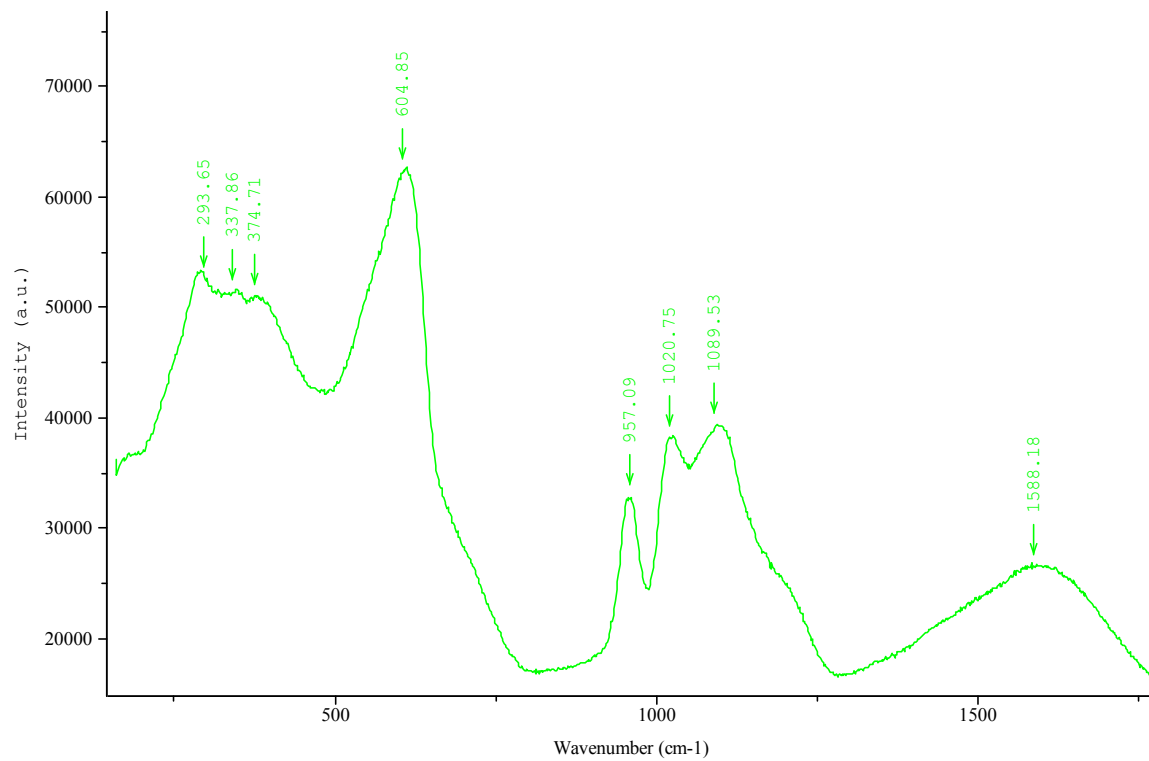


Spectrum 2

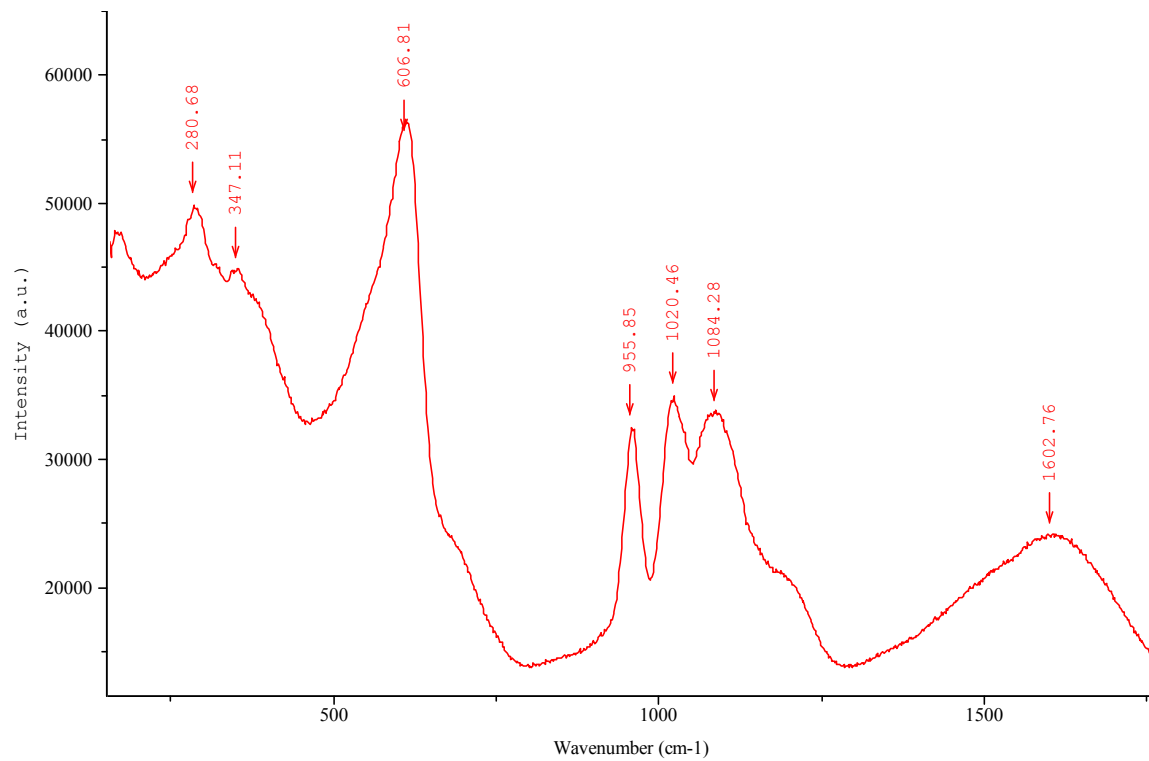




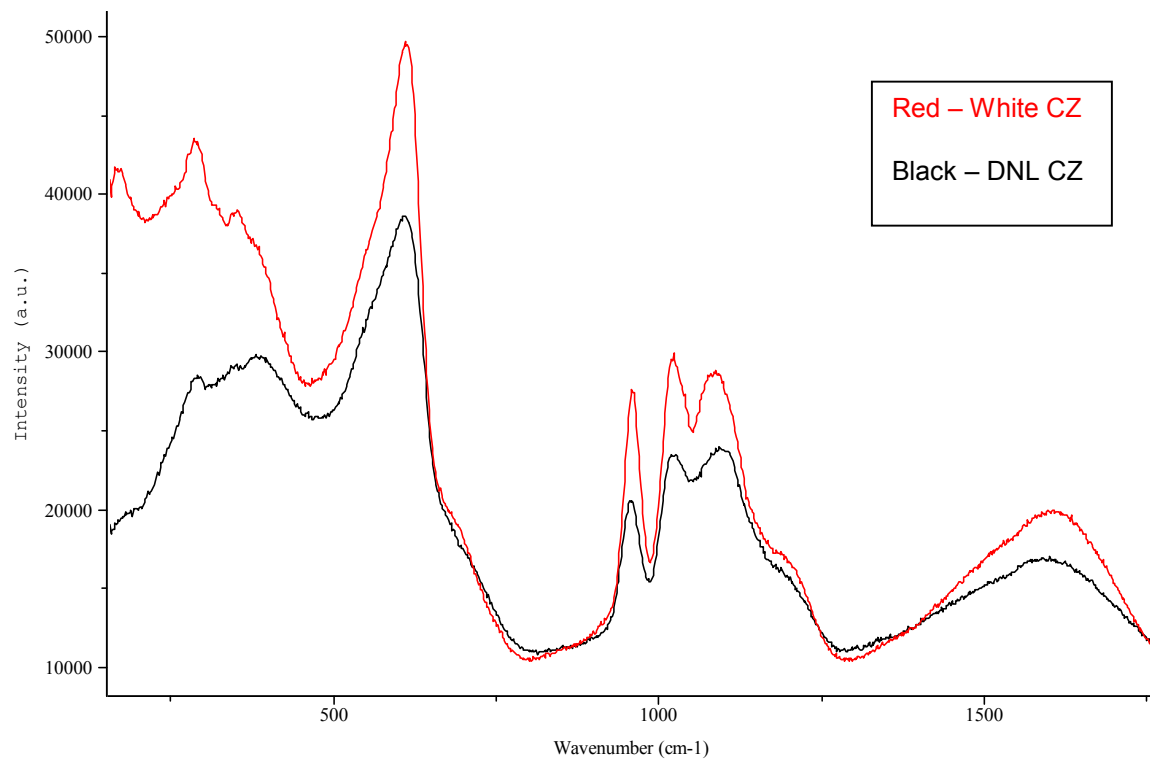
Spectrum 4



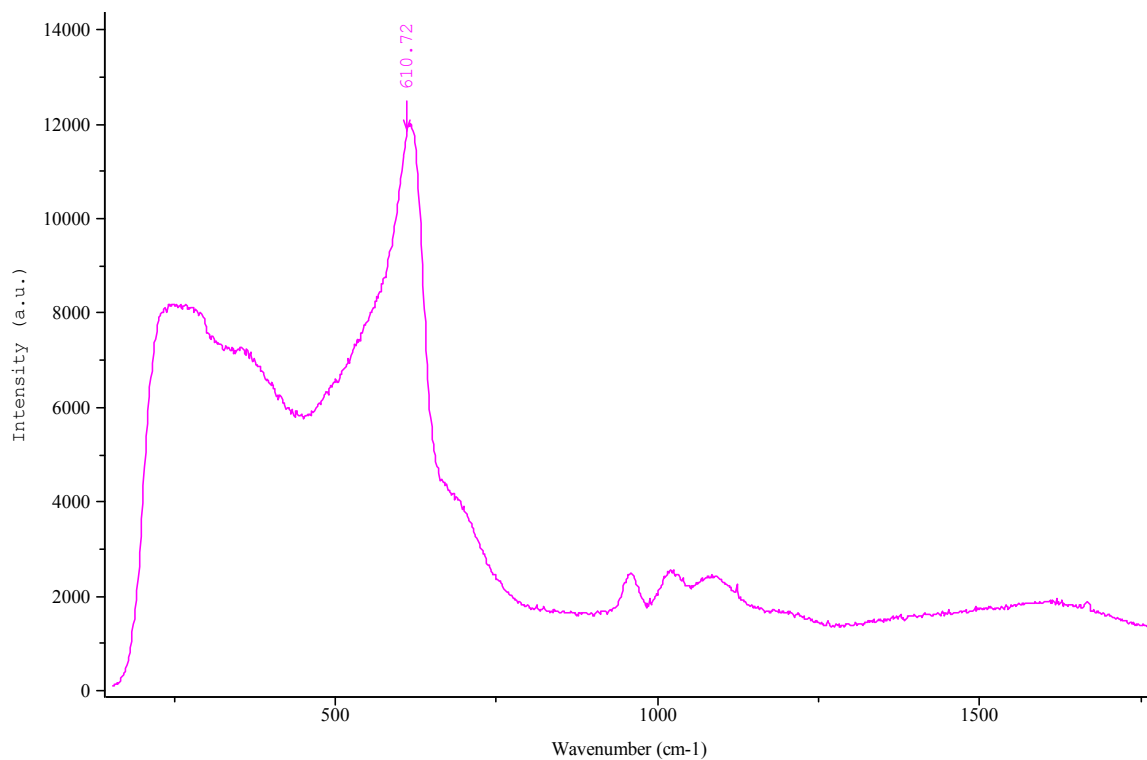
Spectrum 5



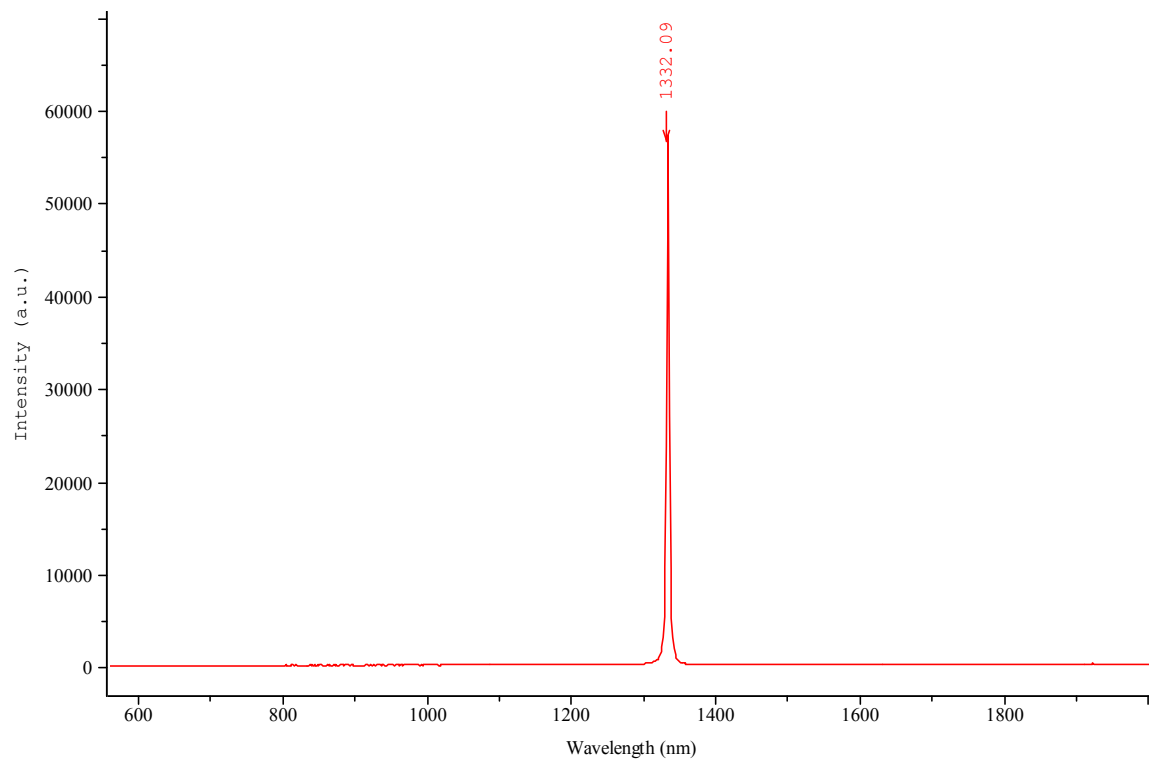
Spectrum 6



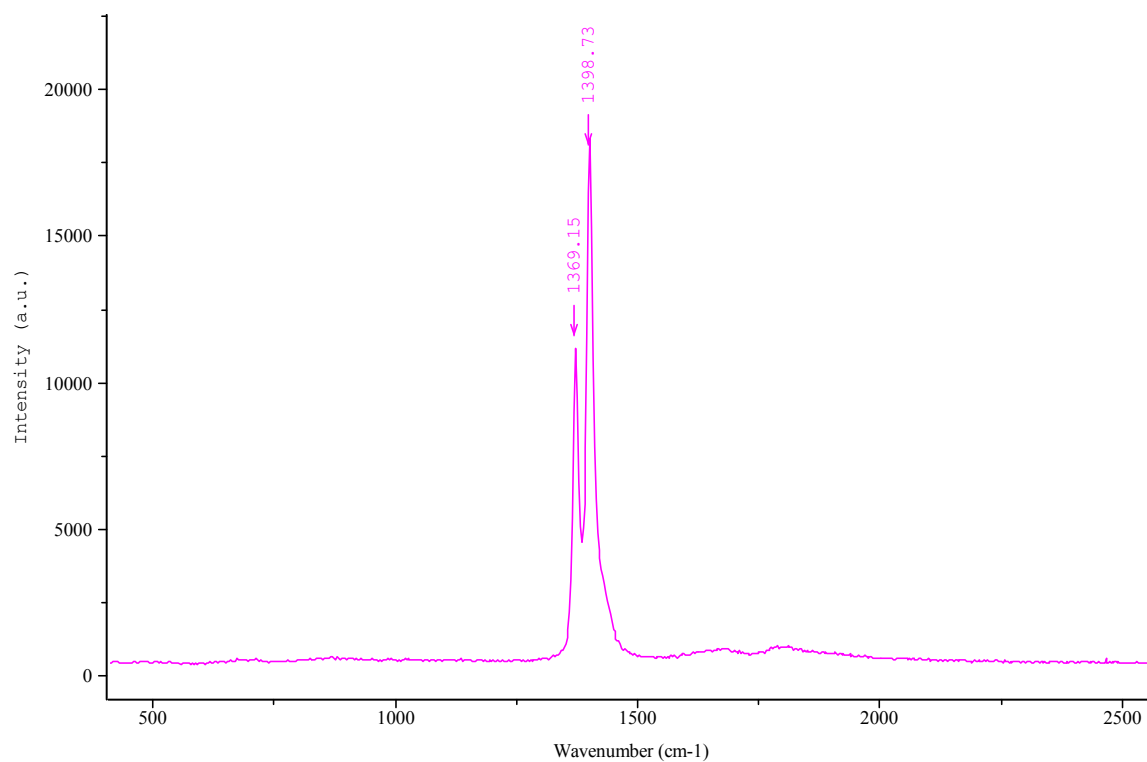
Spectrum 7



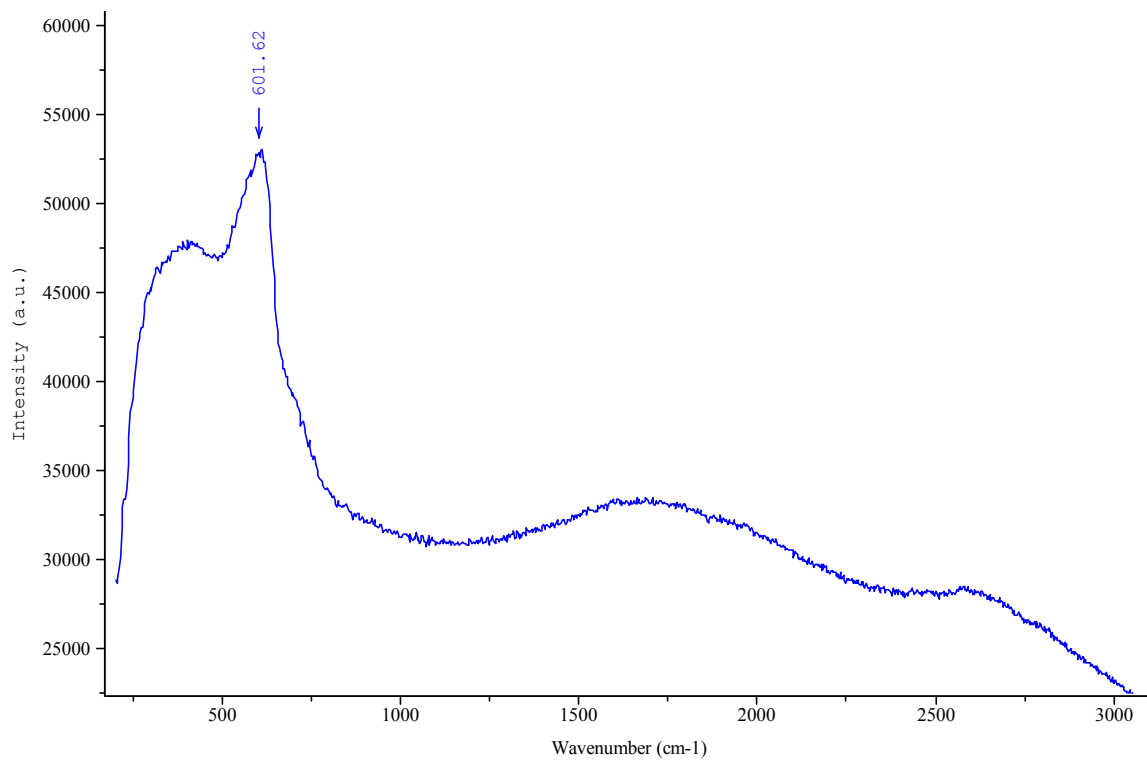
Spectrum 8



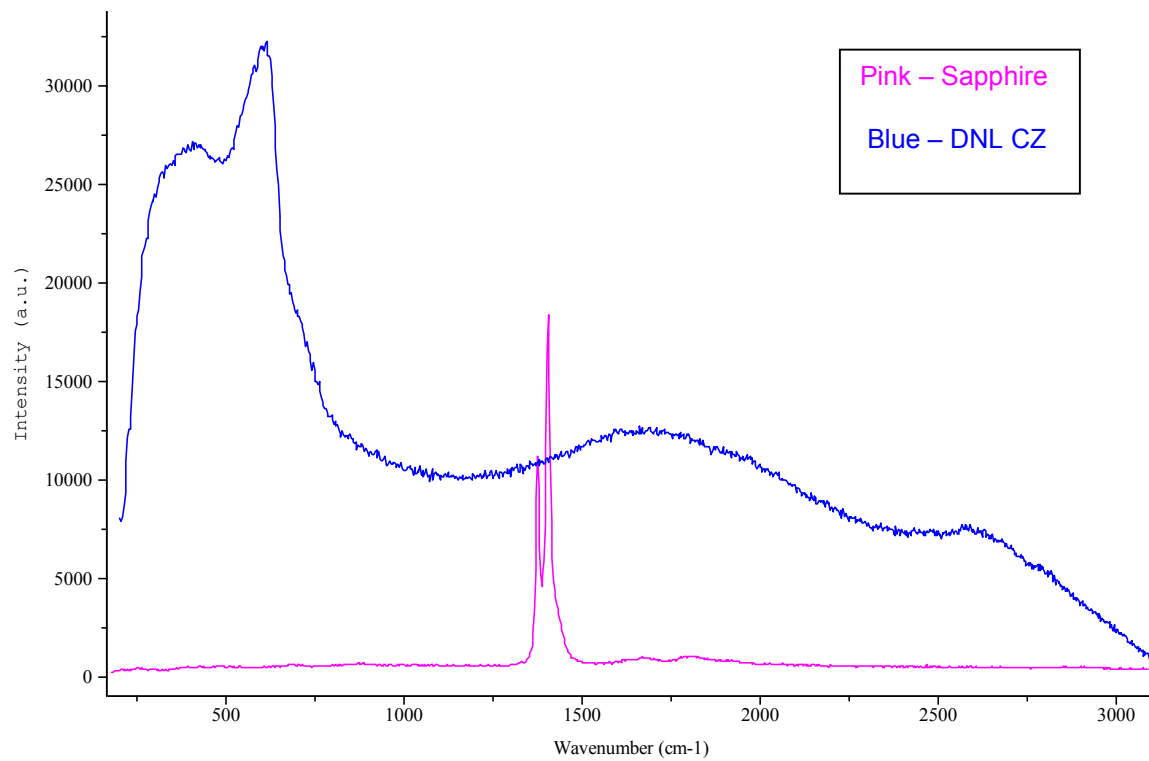
Spectrum 9



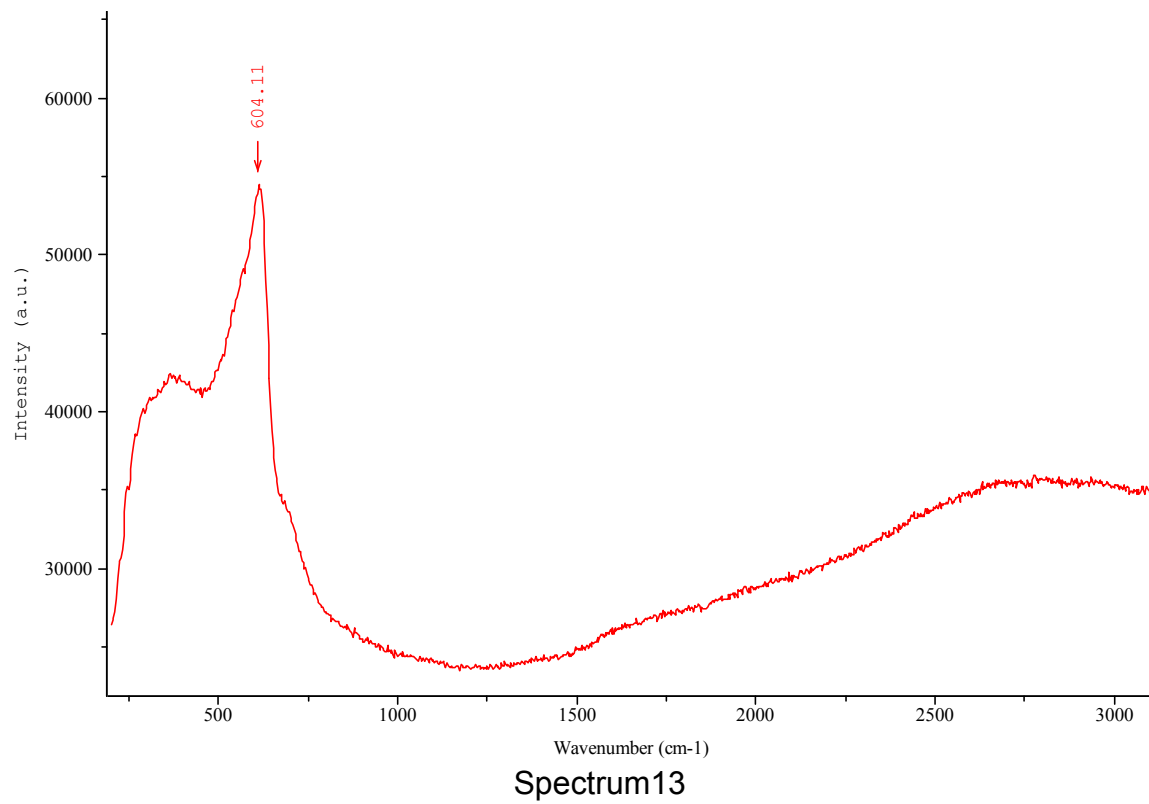
Spectrum 10

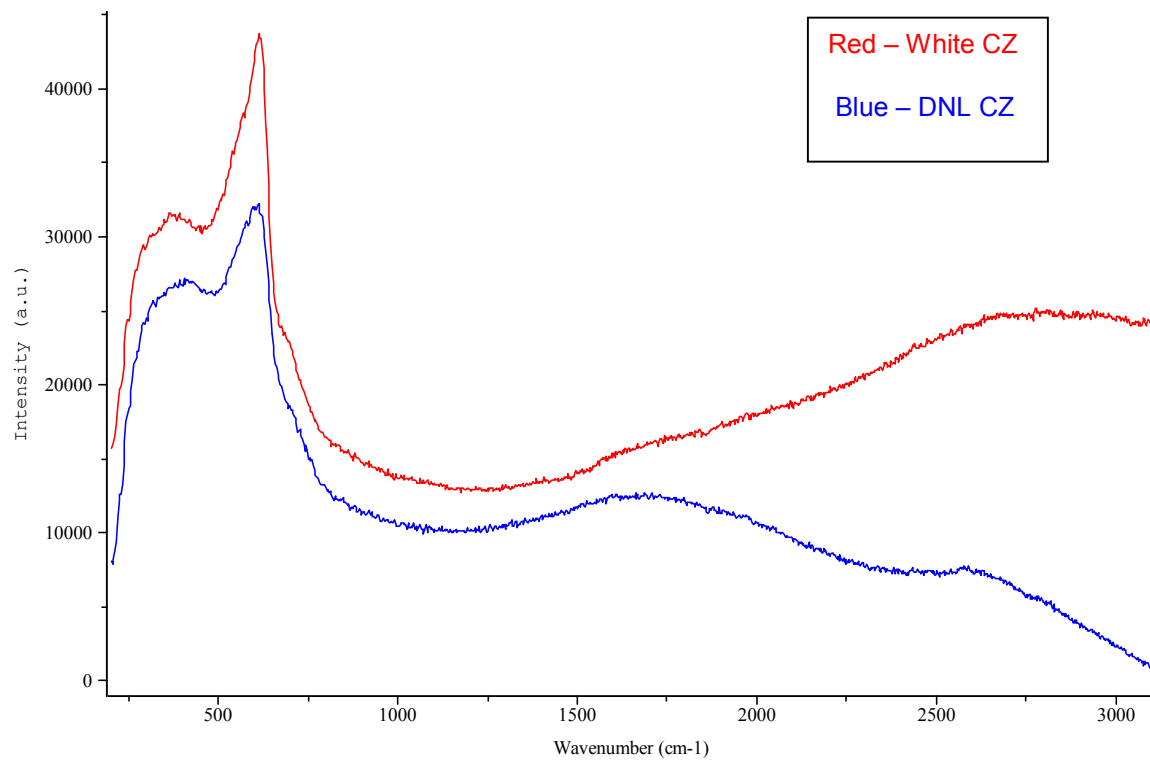


Spectrum 11



Spectrum 12





Spectrum 14