

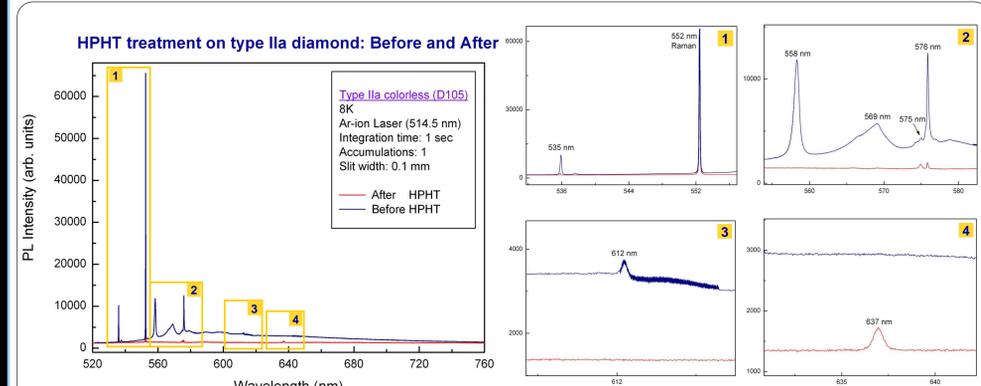
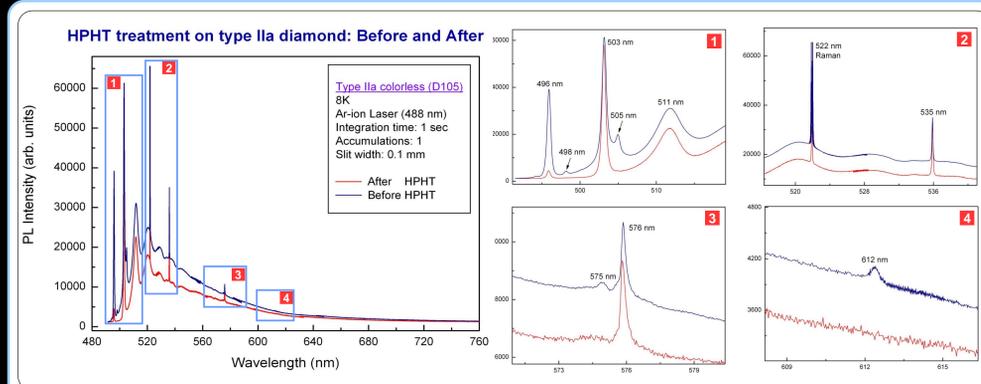
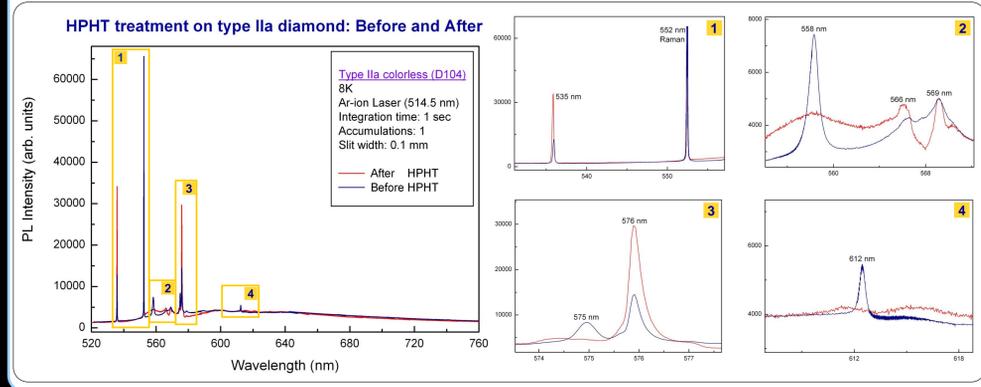
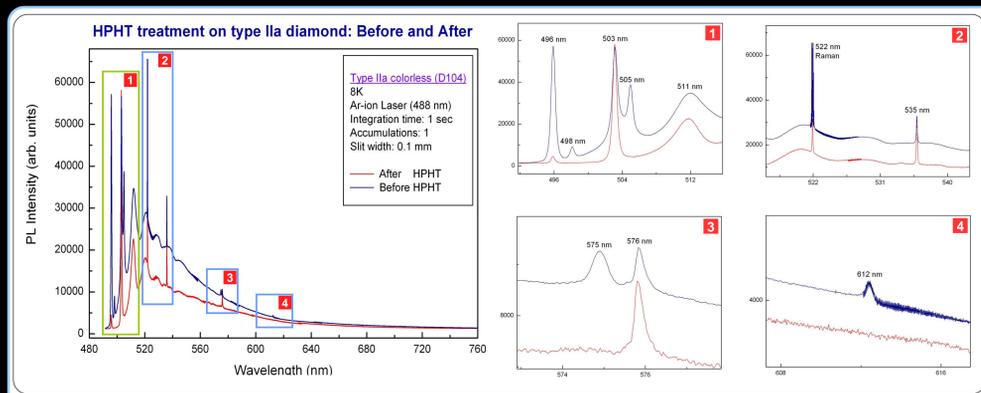
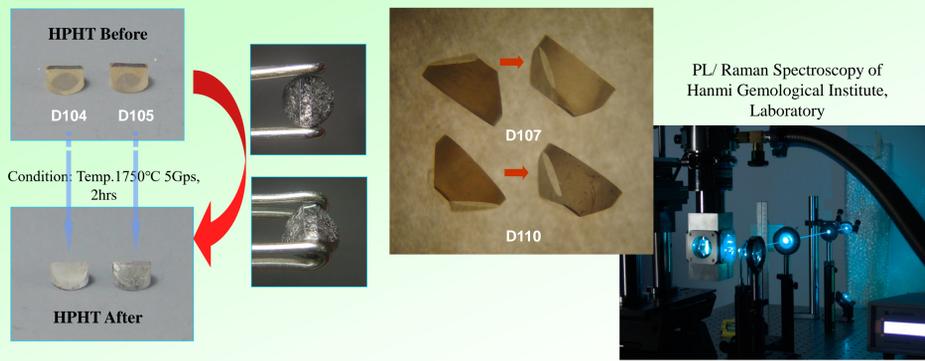
Photoluminescence study of HPHT processed natural type IIa diamond

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Abstract

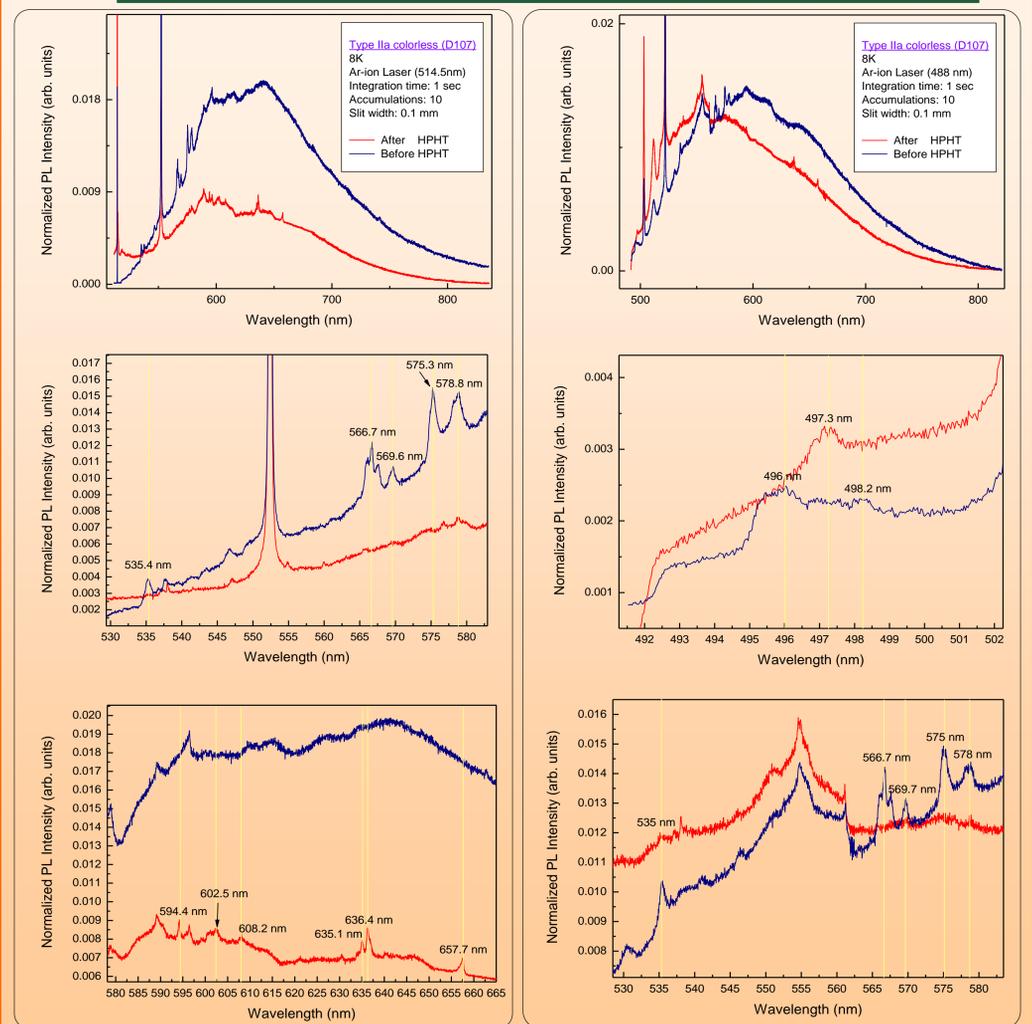
Annealing at high pressures and temperatures (HPHT) has been used to remove the brown color from type IIa diamonds, and to change the colors of certain type I and type II diamonds. In some cases, evidence of this process exists in the form of heat damage to surfaces, and graphite formation along fractures and at inclusions. However, such visual clues are not always present, and identification of HPHT processed diamonds requires the use of visible, infrared, and luminescence spectroscopy methods to check for distinctive spectral features. In particular, photoluminescence studies very sensitive method clearly illustrated that minute amounts of nitrogen impurities are present in all of these type IIa samples, even though IR spectroscopy could not always detect them, and revealed the presence of a considerable number of point defects dispersed throughout the crystal lattice. In the present investigation we have measured the photoluminescence spectra of natural IIa type brown diamonds before and after they have been annealed in HPHT method. Several peaks were removed completely after HPHT process, including the 494.2, 498.2, 503.4 (3H), 505, 542.7, 557, 558.3, 566.7, 569.7 and 612 nm. Also, some peaks were reduced, including those at 496.2 (H4), 503.2 (H3), 535, 575 (N-V)⁹ and 637 (N-V) nm. However, the 637 nm peak was generated some samples that 637 nm didn't exist before HPHT process.

HPHT annealed Diamond



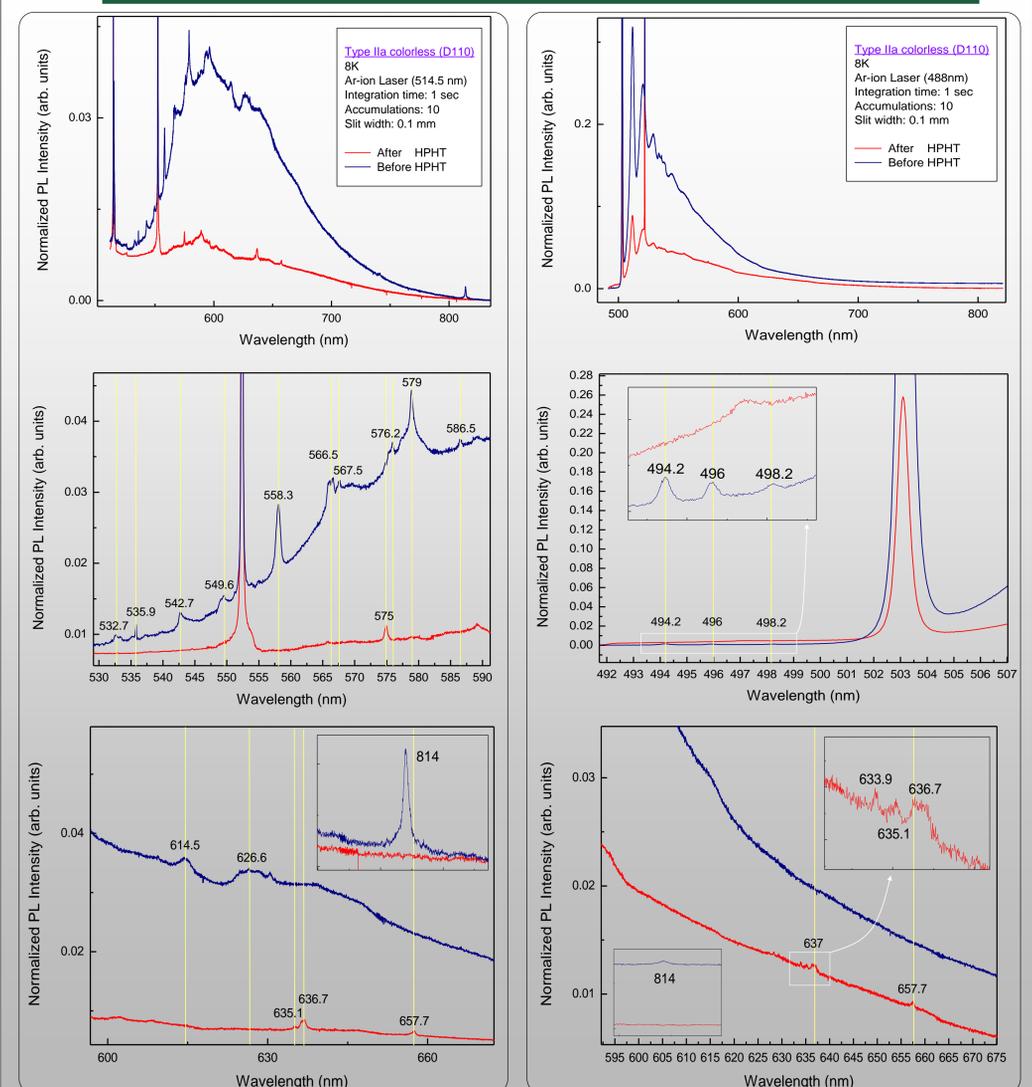
D107 before polishing (514.5/488)

Disappeared: 496, 498.2, 535, 566.7, 569.7, 575, 578
 Generated: 497.3, 594.4, 635.1, 636.6, 657.5



D110 before polishing (514.5/488)

Disappeared: 494.2, 496, 498.2, 535.9, 579
 Generated: 575, 635.1, 636.7, 657.7, 814



Summary

- Photoluminescence studies very sensitive method clearly illustrated that minute amounts of nitrogen impurities are present in all of these type IIa samples, even though IR spectroscopy could not always detect them, and revealed the presence of a considerable number of point defects dispersed throughout the crystal lattice.
- HPHT processing resulted in significant modification. Many PL features were removed, reduced and generated.
- On the basis of the results obtained from this before and after study, we believe that we can separate natural color type IIa diamonds from HPHT processed.