OSL RADIATION DOSIMETRY USING BORON DOPED CVD DIAMOND FILMS

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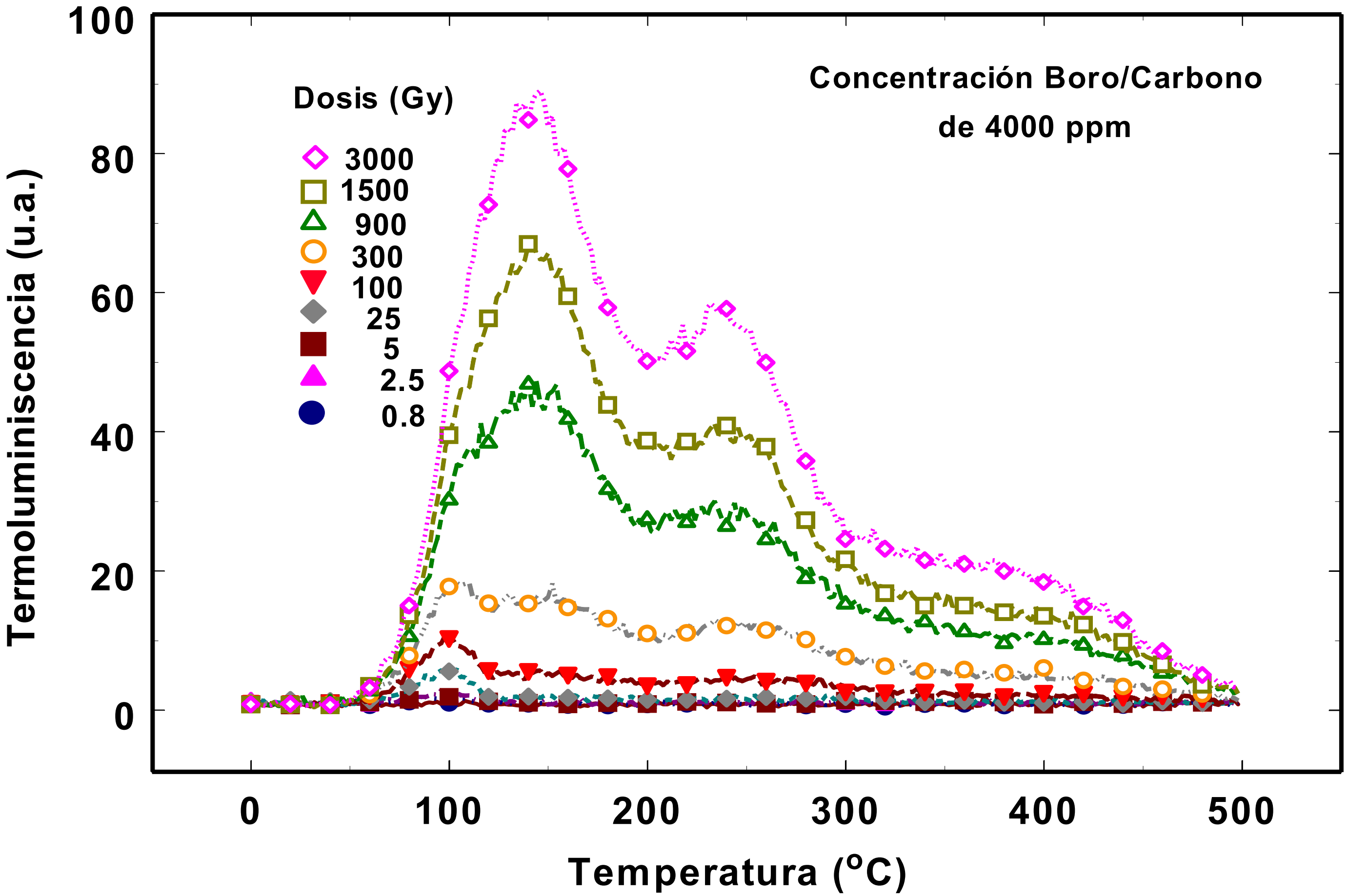
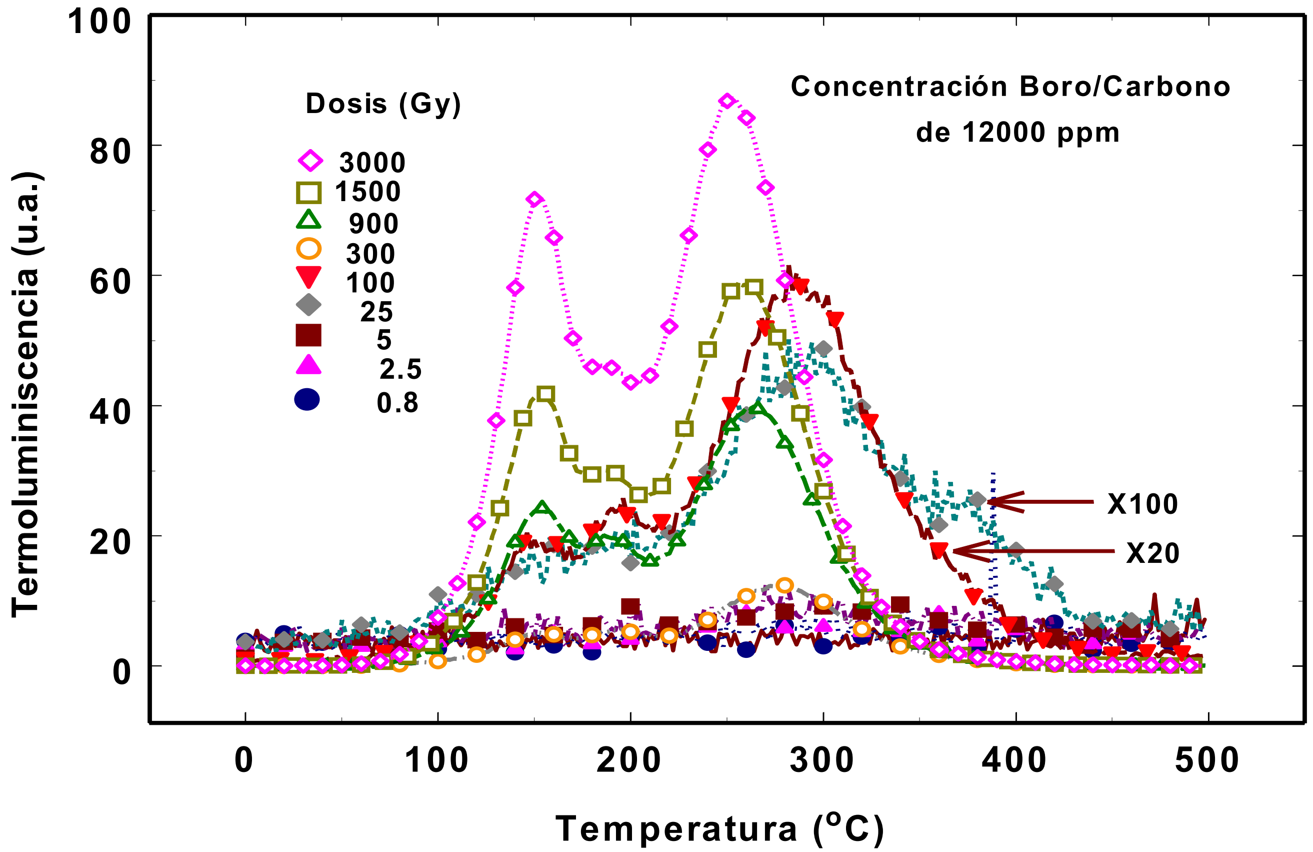
The optically stimulated luminescence (OSL) properties of chemically vapor deposited (CVD) boron doped diamond films exposed to β radiation were investigated. Diamond thin films deposited on silicon (111) containing a B/C ratio of 2 000, 4 000, 8 000, 12 000 and 20 000 ppm were exposed to a β -ray dose of 0.8 – 3000 Gy. After stimulation with 470 nm light the OSL decay curve was measured and found it to be proportional to the dose exposure. The thermoluminescence (TL) glow curve indicate the existence of main charge carriers traps around 150 and 250 ºC for a diamond film with B/C ratio of 12 000. The OSL emission appears to originate from charge trapped at the 150 ºC glow peak. The results indicate that CVD diamond films performs well as OSL dosemeter for ionizing radiation; however additional investigation is needed in order to fully understand the nature of the trapping and recombination mechanism responsible for the OSL dosimetric properties. This work was supported by Fundação de Amparo a Pesquisa do Estado de São Paulo (FAPESP). We acknowledge financial support from SEP and Conacyt grants No.36521, 37641 and 32069.

Thermoluminescence of diamond thin films



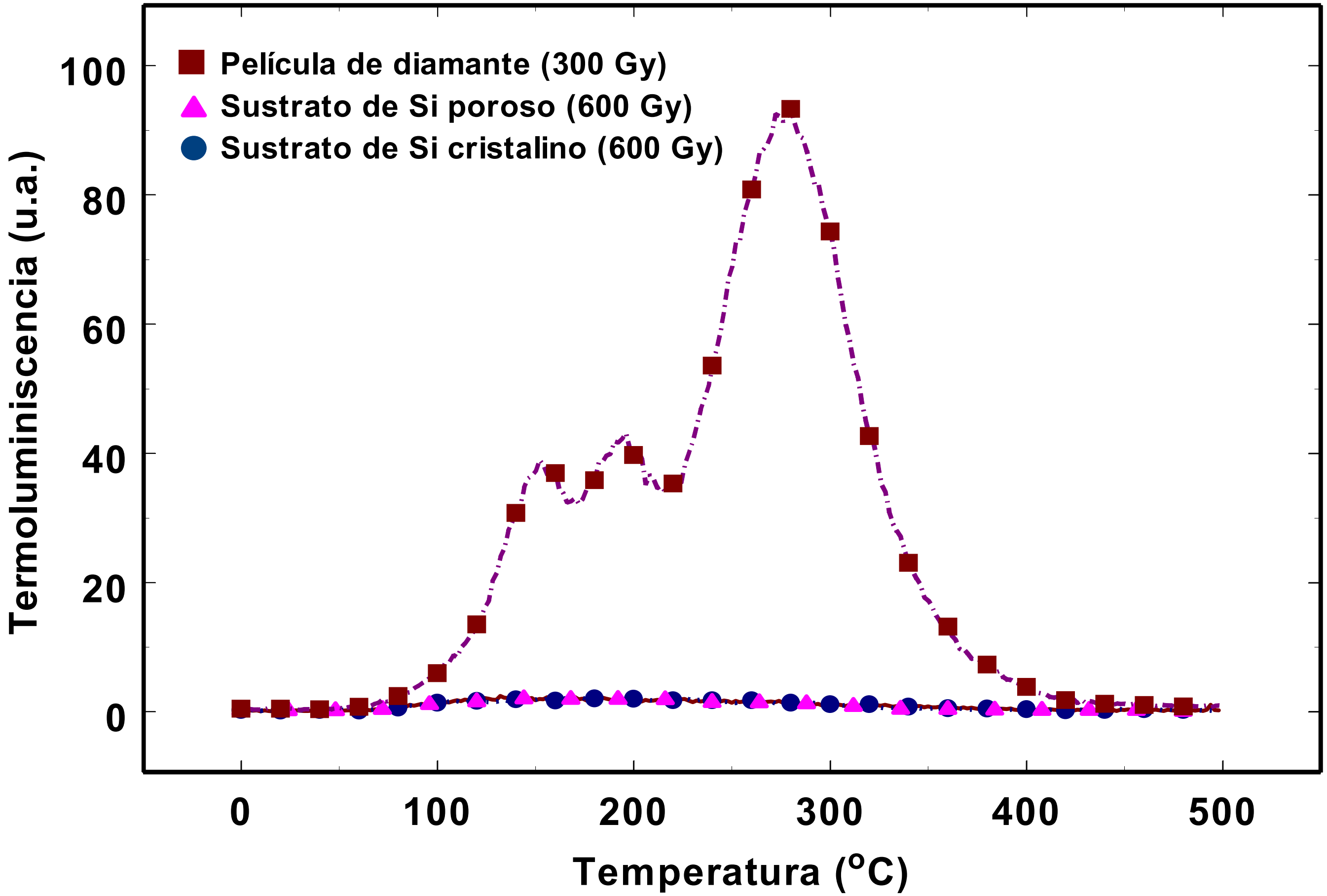
- Figura 1.- TL glow curves of beta irradiated diamond films de B/C de 4000 ppm.

Thermoluminescence of diamond films



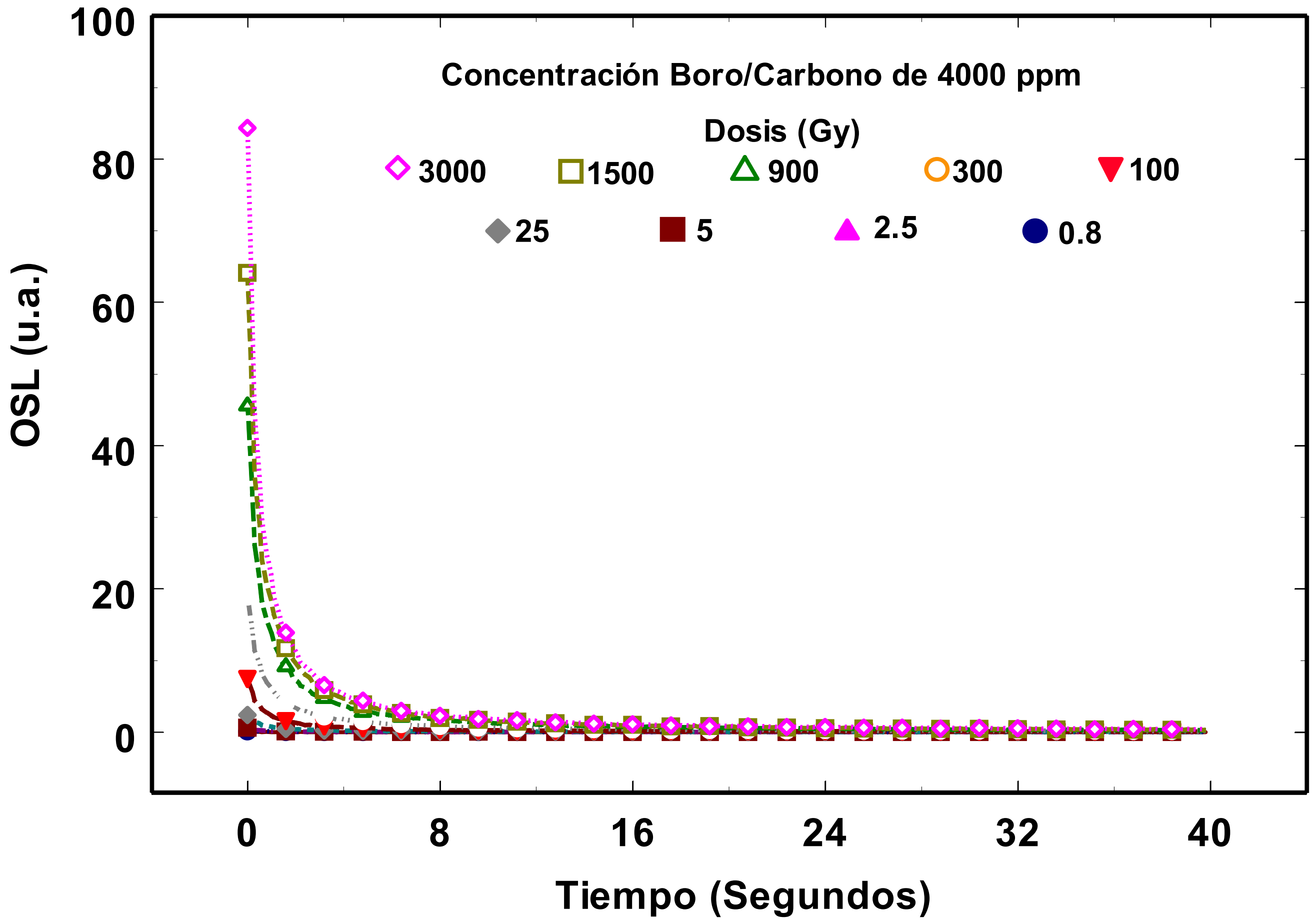
- Figura 2.- TL glow curves of diamond films B/C = 12000 ppm, exposed to beta rays at diferent doses.

Thermoluminescence of daimond films



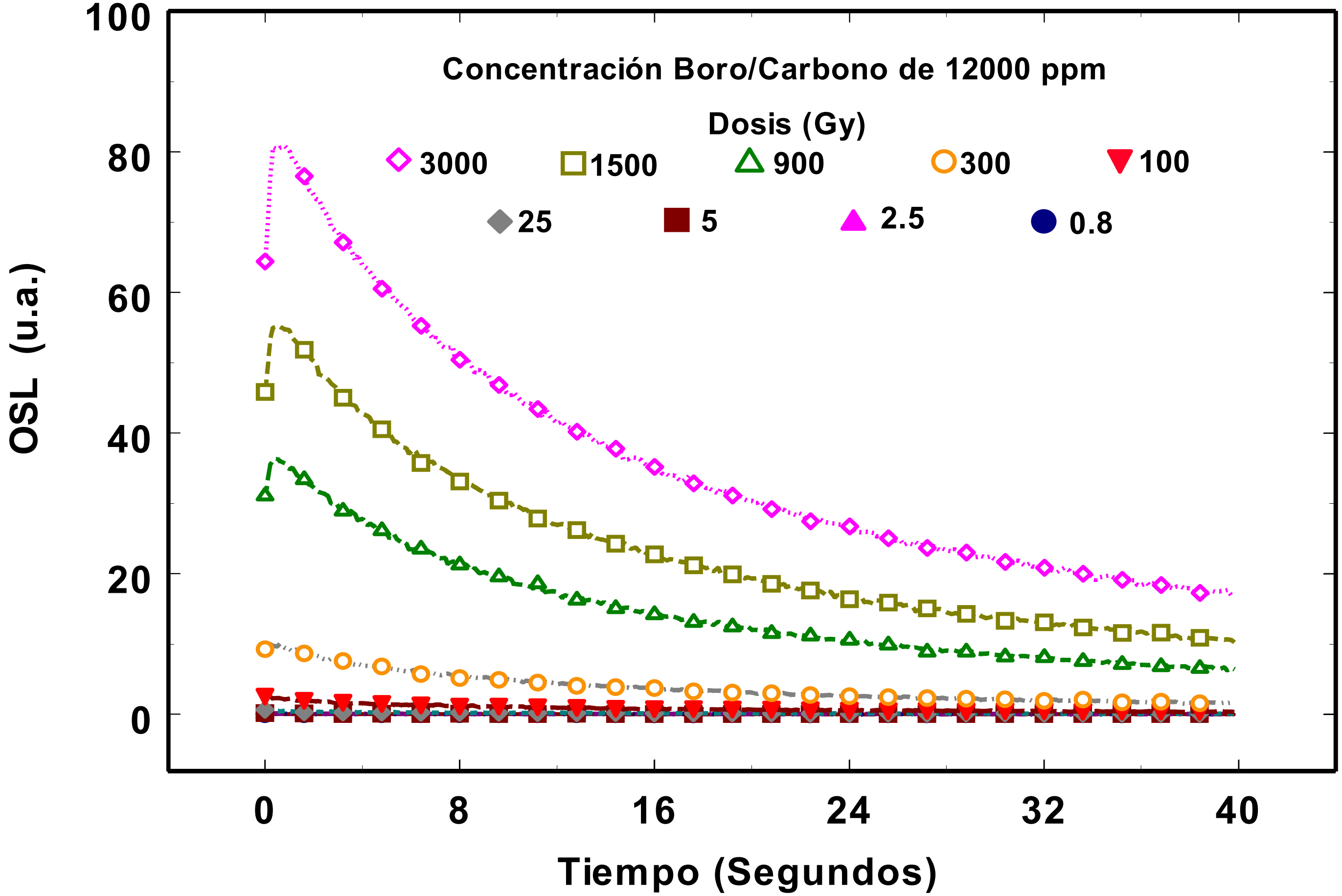
- Figura 3.- TL glow curves of a diamond film with B/C = 12000 ppm as compared to the TL obtained from a crystaline and porous Si substrate.

OSL of diamond films



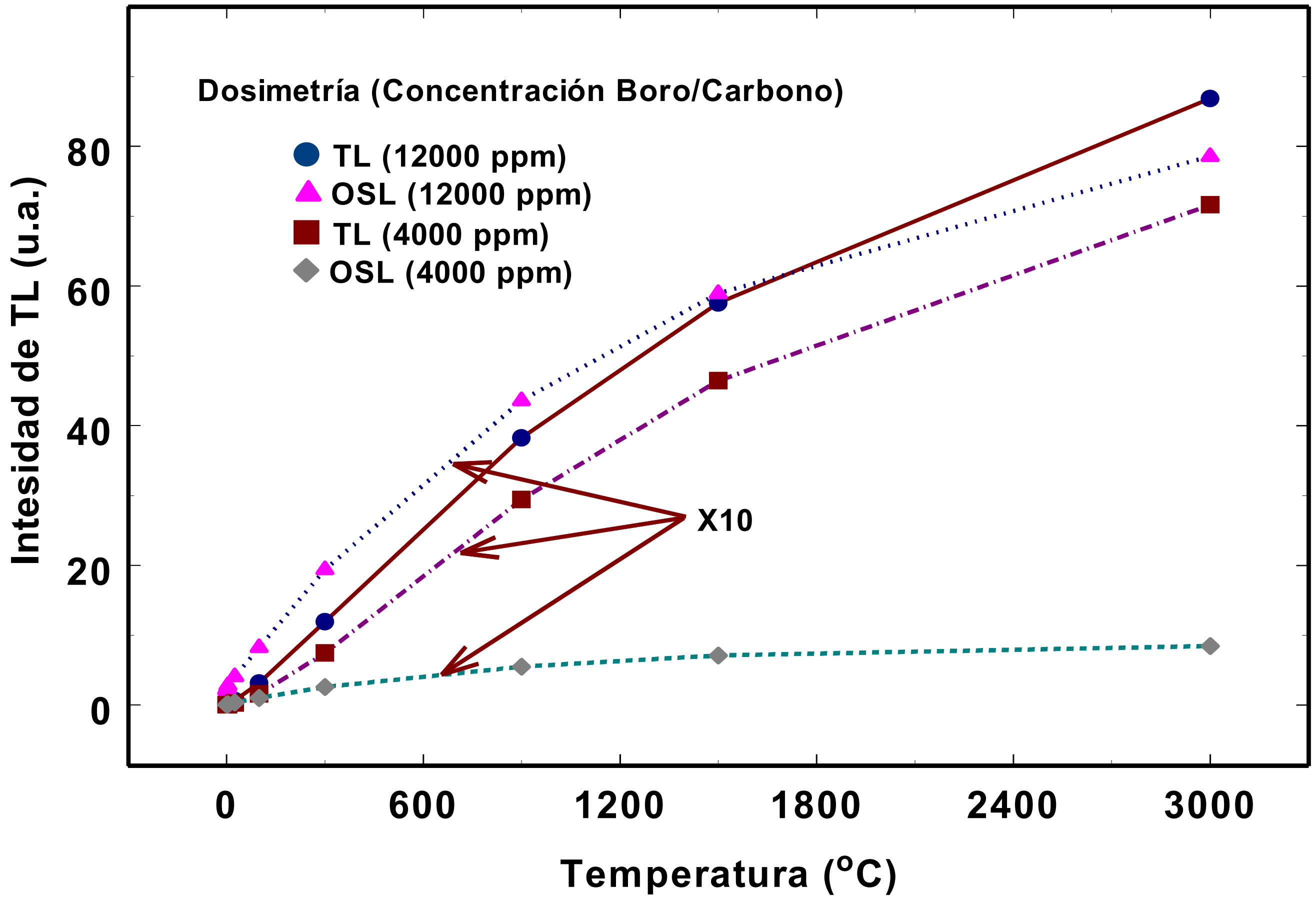
- Figura 4.- OSL of diamond film containing B/C = 4000 ppm exposes toa beta irradiation and photostimulated with blue light.

OSL of diamond films



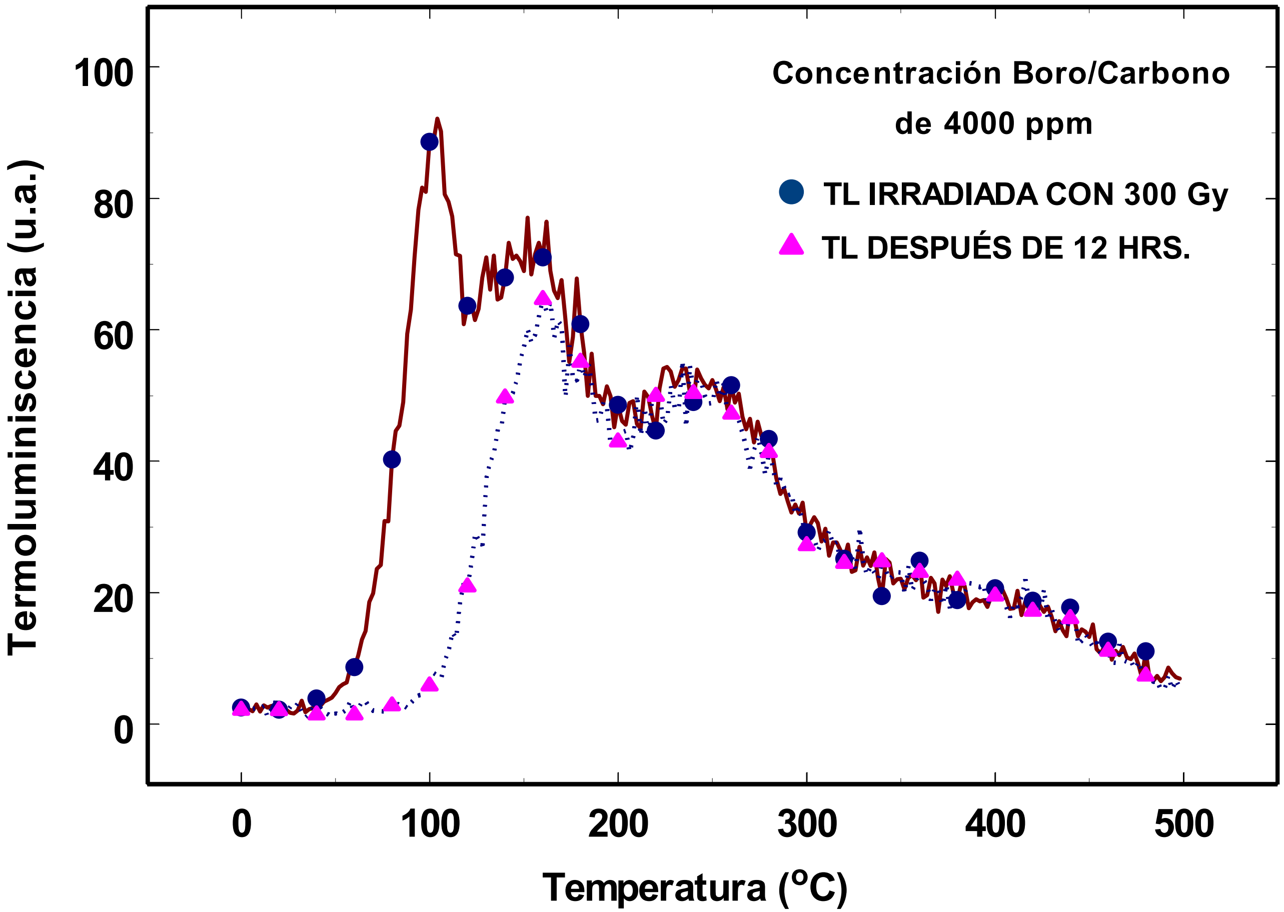
- Figura 5.- OSL of diamond film containing B/C = 12000 ppm exposed to beta rays and photostimulated with blue light.

TL and OSL dosimetry



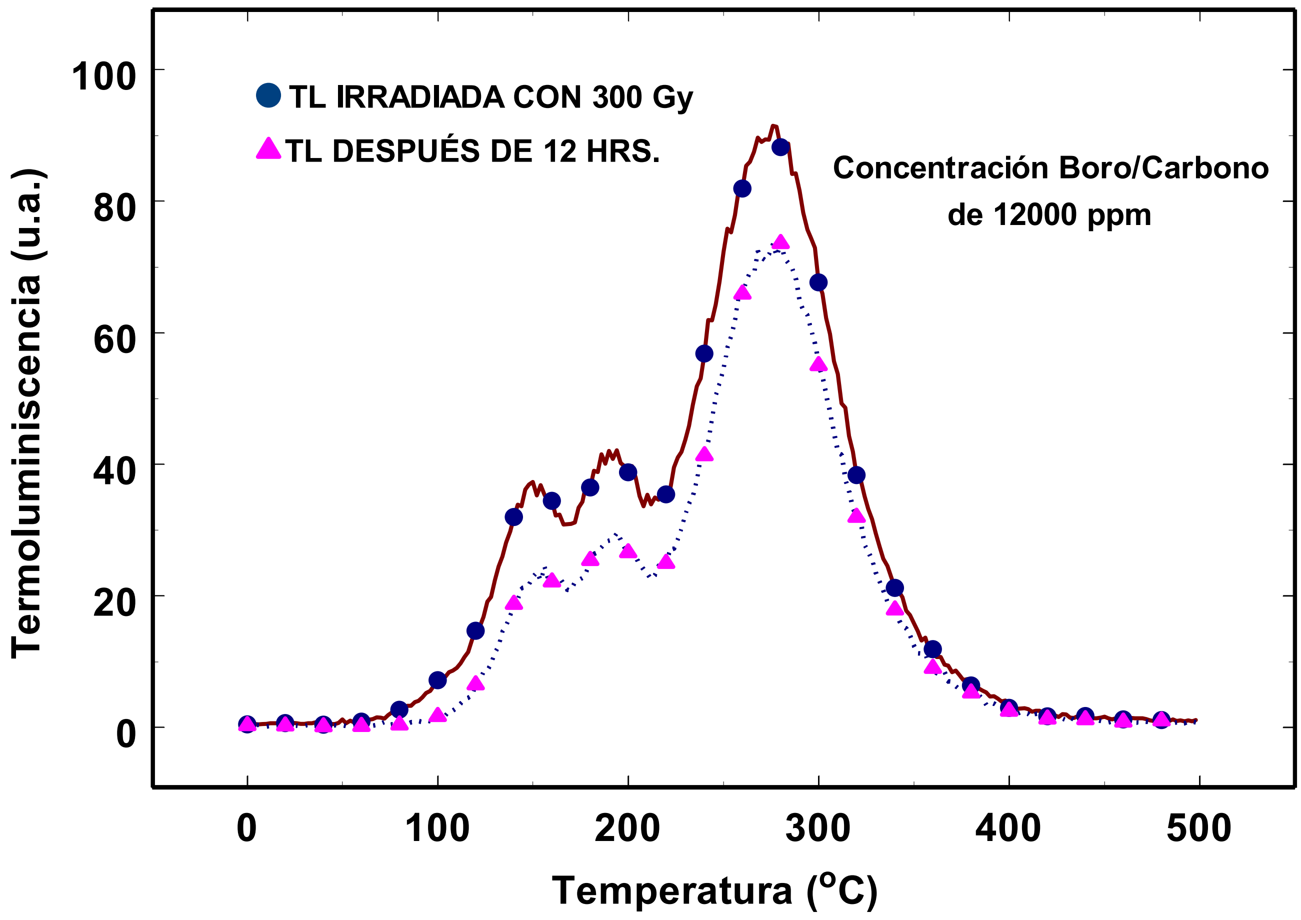
- Figura 6.- Dosimetric behavior of diamond thin films containing different B/C concentration.

TL fading



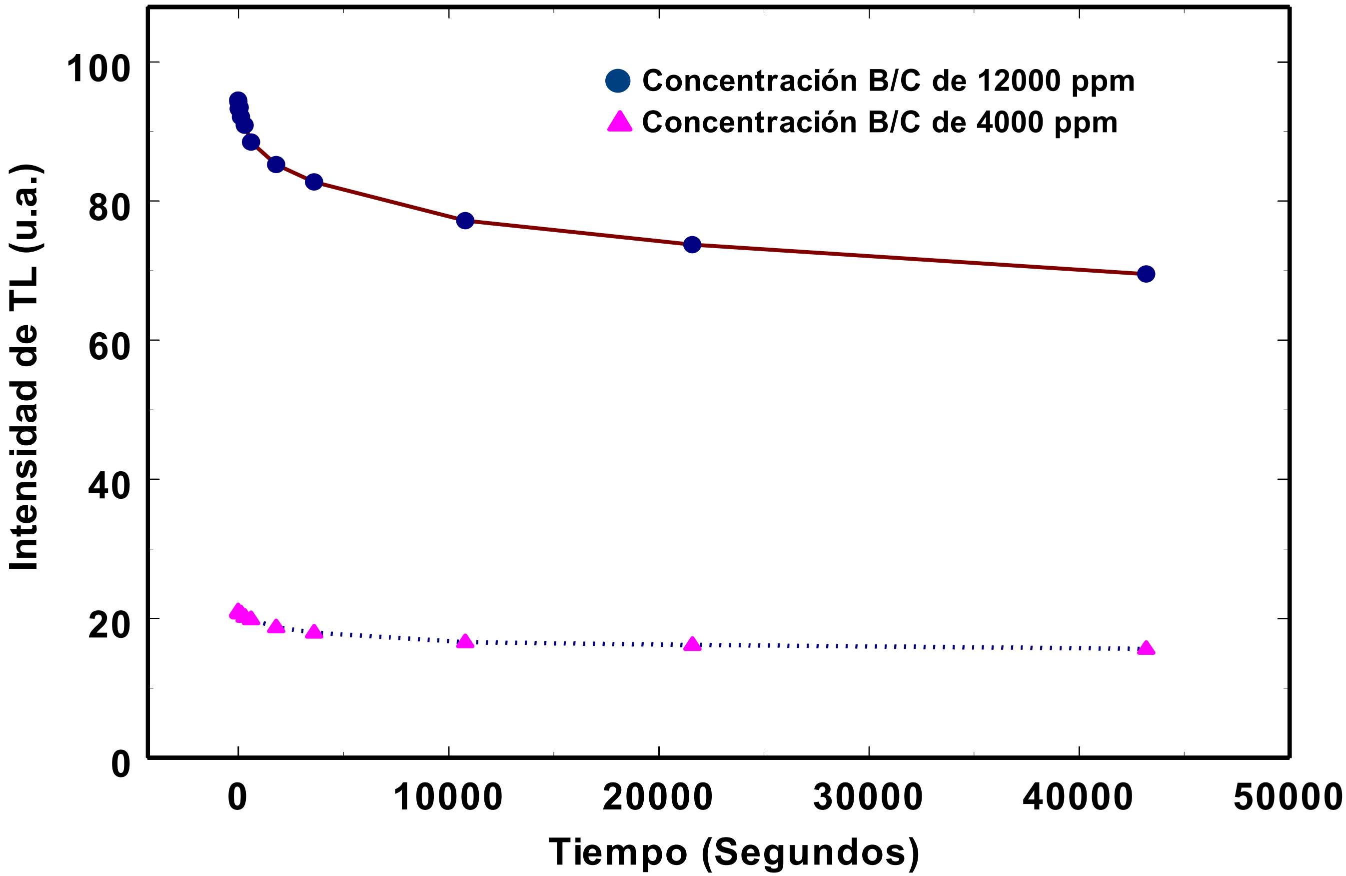
- Figura 7.- TL fading of a diamond film containing B/C = 4000 ppm exposed to 300 Gy of beta irradiation.

TL fading



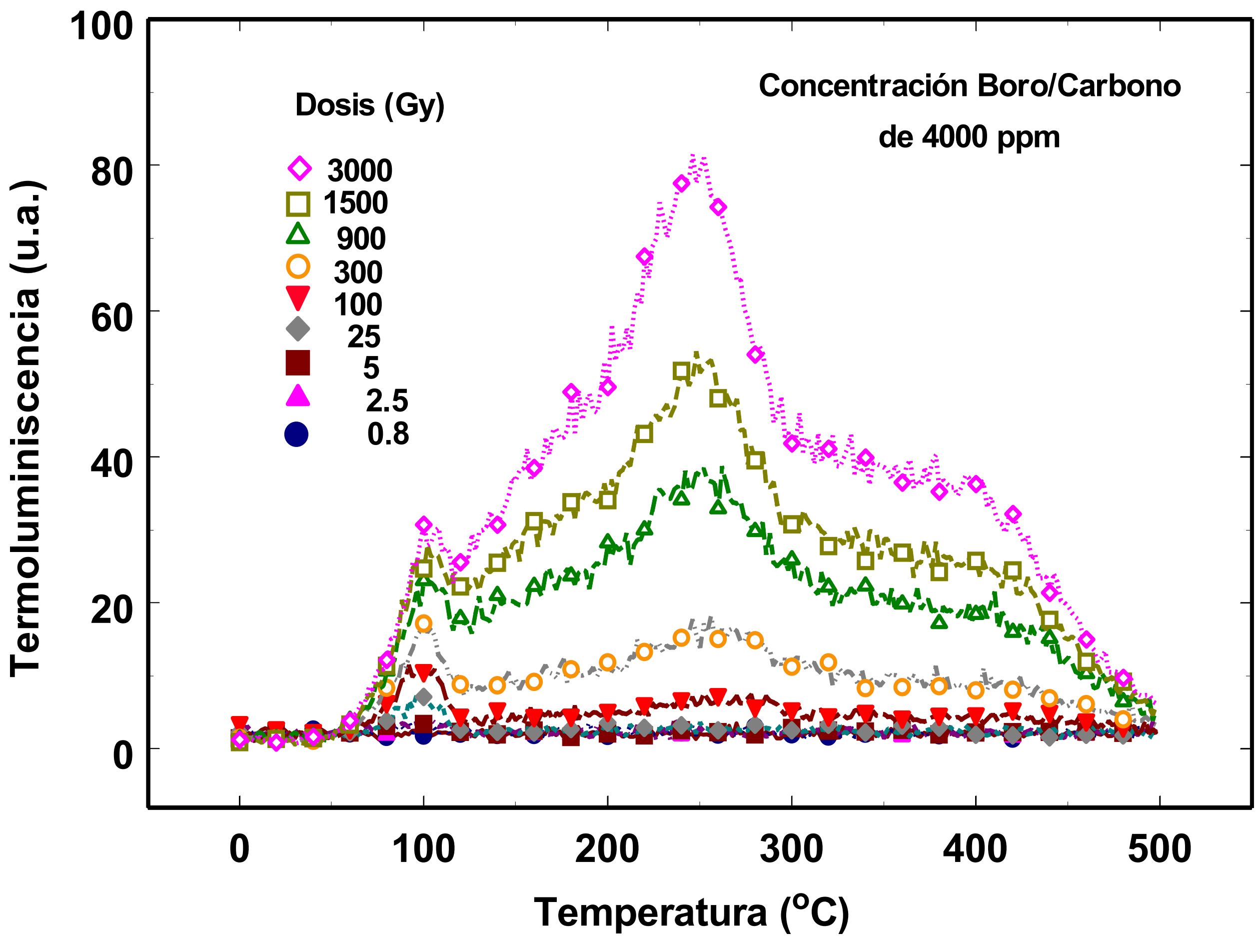
- Figura 8.- TL fading of a diamond film B/C = 12000 ppm, exposed to 300 Gy of beta irradiation.

TL fading



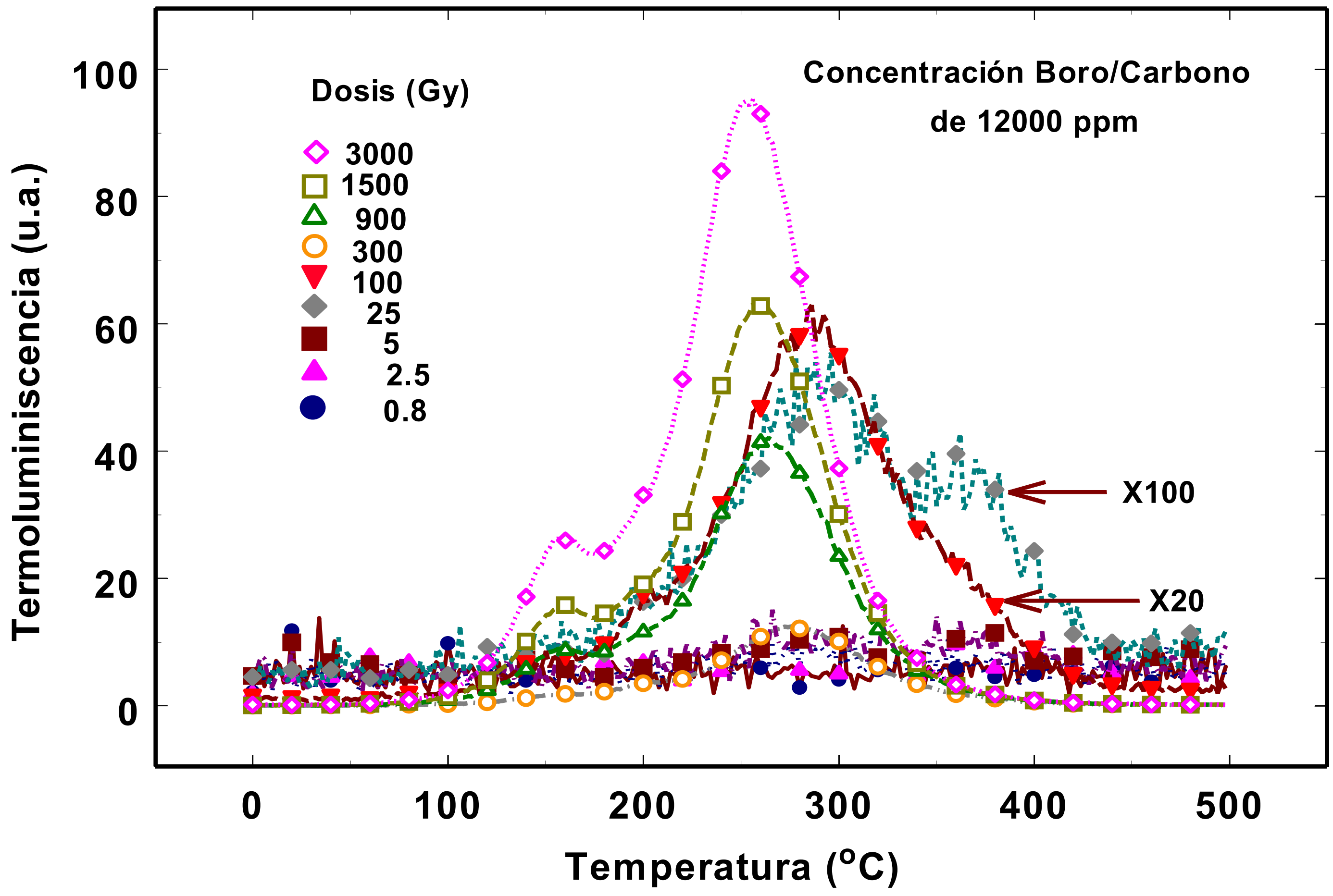
- Figura 9.- TL fading of diamond samples containing B/C = 4000 and 12000 ppm, after 300 Gy of beta rays.

Residual TL after OSL



- Figura 10.- Residual TL after OSL for diferent irradiation beta doses.

Residual TL after OSL



- Figura 11.- Residual TL (diamond film with B/C = 12000 ppm) after OSL at diferente bet irradiation dose.

Conclusions

- The TL as well as the OSL signal increases as the concentration of B/C increases.
- The existence of TL after OSL indicates diferent recombination mechanisms for the TL and OSL processes.
- TL signal appears in both sides of the substrate. It is necessary to identify what causes TL and OSL.
- TL stability is found in samples with lower B/C concentrations.
- The OSL decays more faster in samples of lower B/C concentration.