Changes of Boron Nitride Luminescence as a Result of X-Ray Irradiation

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There were different motives for the studies presented in this paper. Firstly, the broadband photoluminescence (PL) of BN can be tentatively attributed to defects and it is interesting to verify whether X-rays can influence the PL; and if they do, what is the nature of such defects - are the changes temporary or permanent. Secondly, it was found that after the irradiation of BN layers with electrons changes in Raman or PL spectra can be observed. Our aim was to corroborate whether comparable changes can be produced with X-rays. Thirdly, we wanted to determine whether boron nitride could be potentially used as a dosimetric material. Once devices based on boron nitride will be used in the future, dosimetric properties of this material could be addressed to estimate doses of ionizing radiation absorbed by people in nuclear or radiation accidents.

Measurements were performed at room temperature on a few samples of BN in various forms - powder, exfoliated and epitaxial layer. In order to observe influence of X radiation on the photoluminescence, we irradiated samples with a collimated beam of X-rays that was generated by a $\mathrm{Cu}_{\mathrm{K}_\alpha}$ X-ray tube, for a few different periods of time t_R. After each irradiation time, the X-ray beam was turned off and a laser beam exciting the PL (wavelength of 488 nm, power of about 100 mW) was simultaneously set on. A luminescence integration time was set to 1 min for every spectrum, to determine a time evolution of the luminescence with a step of 1 min.

No structural changes of BN were found after irradiation with X-rays. We observed that X-rays influenced intensity of the PL in the whole registered spectral range between 550 nm and 900 nm.

To conclude, it was shown that the PL of boron nitride is sensitive to X-ray irradiation produced with a standard X-ray tube that is generating photons with the energy of 8 keV. Which also shows possible potential of used material in dosimetrical applications.