High-pressure photo-luminescence spectra of BN single crystals
doped with lanthanides

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Luminous cubic boron nitride (c-BN) single crystals, doped with Eu, Tb, and Sm, respectively, have been first synthesized using a temperature gradient method under high pressure [1]; the photo luminescence (PL) of Eu-implanted c-BN was once investigated at atmospheric pressure [2]. The Eu-doped c-BN single-crystal synthesized this time shows a strong and sharp peak at around 712 nm, which is due to an intra-4f electron transition of Eu³⁺: ⁵D₂→⁷F₄. Thus we have investigated the pressure change in the luminescence.

The high-pressure PL spectra have been measured using a diamond anvil cell. A single crystal with a dimension of about 50 x 50 μm² was put in a sample chamber with a mixture of methanol-ethanol (4:1 by volume) and a ruby ball. The pressures loaded on the sample were determined using the fluorescence of ruby.

The PL spectra were measured using an excitation wavelength of semiconductor lather (λ=400 nm). The pressure change in the peak frequency observed by loading up to 10 GPa is shown in Fig. 1. The frequency monotonously increases with pressure by a variation ratio, 0.275 nm / GPa, which is smaller than that of R1 of ruby [3].

References: