Comparative optical study of Eu^{3+} ions doping in InGaN/GaN quantum dots and GaN layer grown by molecular beam epitaxy

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Abstract: We report on a comparative optical study of InGaN:Eu quantum dots (QDs) and GaN:Eu layer grown by molecular beam epitaxy (MBE). Analysis of the $^5D_0$?? $^7F_2$ transition as a function of the excitation wavelength shows that Eu^{3+} ions in InGaN:Eu QDs are located inside InGaN QDs and also in the GaN barrier layer. The existence of Eu^{3+} ions in the GaN barrier layer is explained by Eu segregation/diffusion during growth. For Eu^{3+} ions located inside InGaN QDs the photoluminescence (PL) shows only a slight decrease with temperature from 5 K to 300 K. In contrast, the PL from Eu^{3+} ions in the GaN barrier layer or in GaN thick layer shows a much more pronounced thermal quenching.

Index Keywords: Gallium nitride; Molecular beam epitaxy; Photoluminescence; Semiconducting indium compounds; Semiconductor doping; Semiconductor quantum dots; Excitation wavelength; Thermal quenching; Europium

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References:

1. Lozykowski, H.J., Jadwisienczak, W.M., Han, J., Brown, I.G., (2000) Appl. Phys. Lett., 77, p. 767
2. Ei Ei, N., H??mmerich, U., Heikenfeld, J., Lee, D.S., Steckl, A.J., Zavada, J.M., (2003) Appl. Phys. Lett., 82, p. 1655
3. Bang, H., Morishima, S., Sawahata, J., Seo, J., Takiguchi, M., Tsunemi, M., Akimoto, K., Nomura, M., (2004) Appl. Phys. Lett., 85, p. 227
4. Hori, Y., Biquard, X., Monroy, E., Enjalbert, F., Le Si, D., Tanaka, M., Oda, O., Daudin, B., (2004) Appl. Phys. Lett., 84, p. 206
5. Andreev, T., Hori, Y., Biquard, X., Monroy, E., Jalabert, D., Farchi, A., Tanaka, M., Daudin, B., (2005) Phys. Rev. B, 71, p. 115310
6. Andreev, T., Hori, Y., Biquard, X., Monroy, E., Jalabert, D., Farchi, A., Tanaka, M., Daudin, B., (2004) Superlattices Microstruct., 36, p. 707
7. Hori, Y., Jalabert, D., Andreev, T., Monroy, E., Tanaka, M., Oda, O., Daudin, B., (2004) Appl. Phys. Lett., 84, p. 2247
8. Shibata, T., Asai, K., Nagai, T., Sumiya, S., Tanaka, M., Oda, O., Miyake, H., Hiramatsu, K., (2002) Mater. Res. Soc. Symp. Proc., 693, p. 541
9. Adelmann, C., Simon, J., Feuillet, G., Pelekanos, N.T., Daudin, B., Fishman, G., (2000) Appl. Phys. Lett., 76, p. 1570
10. Brecher, C., Samelson, H., Lempicki, A., Riley, R., Peters, T., (1967) Phys. Rev., 155, p. 178
11. O'Donnell, K.P., (2004) Mater. Res. Soc. Symp. Proc., 831, p. 96
12. Simon, J., Pelekanos, N.T., Adelmann, C., Martinez-Guerrero, E., Andr??, R., Daudin, B., Le Si, D., (2003) Phys. Rev. B, 68, p. 035312

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