20a-E11-9

Influence of Si-doping on the luminescence and defect evolution of AlN

NIMS[1], Tsukuba Univ.[2], Kagawa Univ.[3] JST[4] ○Y. J. Cho[1, 2], B. Dierre[1], T. Takeda[1], D. H. Son[2], K. Takahashi[1, 2], K. Marumoto[2, 4], Y. Kamigaki[3], N. Fukata[1], N. Hirosaki[1], T. Sekiguchi[1, 2]

E-mail: CHO.Yujin@nims.go.jp

Aluminum nitride (AlN) has significant potential as ultraviolet (UV) emitting powder without rare-earth doping. In our previous study, it was found that Si doping clearly improves the UV emission of AlN powder. The UV luminescence of AlN mainly consists of 2 bands around 3.26 and 3.54 eV, whose ratios vary with the Si concentration [1]. The dominant peak is at 3.54 eV below 1.8 %, while 3.26 eV above it (Fig. 1). Those emissions are attributed to the defects in AlN [2]. However, their origins have not been clarified yet. In this study, we measured electron spin resonance (ESR) measurements in order to identify these defects.

AlN powders doped with Si from 0 to 4 at. % were prepared using high temperature and gas-pressure sintering. Fig. 2 shows the ESR signals of Si-doped AlN powders. The broad and sharp signals with g=2.005 and 1.999 coexist, and the whole signal intensity decreases until 2.0%, then increases again. Fig 3 shows the variation of the ESR signal. The broad signal (g=2.005) is dominant below 1.2 %, while the sharp one (g=1.999) above it. The former may correspond to 3.54eV emission while the latter to 3.26eV.

In summary, we could get the highest UV emission and lowest ESR signal at 2.0 Si %. The CL intensity and ESR signal had a similar tendency. We will discuss the origin of these defects in the presentation.

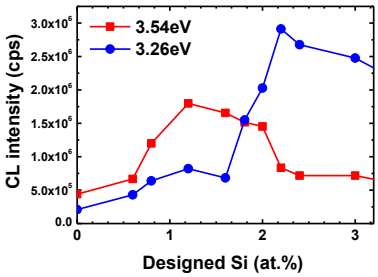

Fig.1. CL intensity of Si-doped AlN powder with different Si concentration.

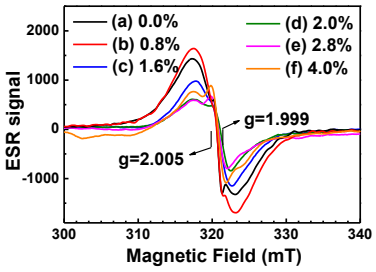

Fig.2. ESR signals of Si-doped AlN powder synthesized at (a)0.0 (c)0.8 (c)1.6 (d)2.0 (e)2.8% and (f)4.0 %.

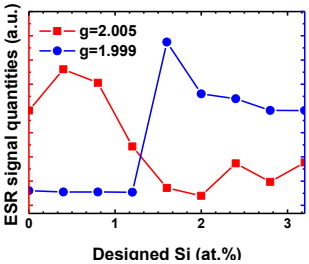

Fig.3. ESR signal quantities changes of Si-doped AlN powders with different Si

[1] The 74th JSAP conference, 17a-D7-4

[2] J. Am. Ceram. Soc. 73, 3238, 1990