Activity modulation MEE growth of group III nitrides on Si(111) using PA-MBE

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1. Introduction

The activity modulation migration enhanced epitaxy (AM-MEE) of plasma assisted molecular beam epitaxy (PA-MBE) method is a candidate to grow high quality group III-nitrides on a large size Si wafer. It is a droplet free growth and an atomic layer epitaxy (ALE). The AM of an rf discharge means selection of chemically active nitrogen atoms (N+N*), where N and N* are ground and excited atoms, respectively, produced by a high brightness (HB) discharge and physically active excited nitrogen molecules N_2* produced by a low brightness (LB) discharge[1].

In this report using the AM-MEE AlN and GaN films on Si(111) is shown and the charaltalization of these films is presented.

2. Experimental

VG-80H MBE chamber was operated with IRFS-501 rf nitrogen radical source made by Arios Inc. After preparing a DBL of AlN/β-Si_3N_4/Si, which is formed by reactive epitaxy with Al and an intermediate layer of β-Si_3N_4 [2-3] on Si, AM-MEE growth of AlN and GaN was performed. The detailed procedure is shown in elsewhere[3-5]. The time sequence of the opening a shutter of an Al or Ga effusion cell during the AM-MEE was used for the trigger signal to operate the mode change operation of nitrogen RF discharge between HB and LB modes as shown in Fig. 1.

3. Results and discussion

The effect of exposure N_2* is shown in Fig. 1. Without sample rotation and exposure of N_2* flux under LB mode with shutter open condition in time sequence of (a), film thickness distribution is uniform and thin at the central part. For the time sequence (b) in Fig. 1 no N_2* flux was exposed by closing the N shutter. The white line shows the stoichiometric position during growth and thickness maximum position.

Full width at half maximum (FWHM) of $\omega/2\theta$ for 171.3 nm thickness AlN (0002) films was 7.1 arcmin.

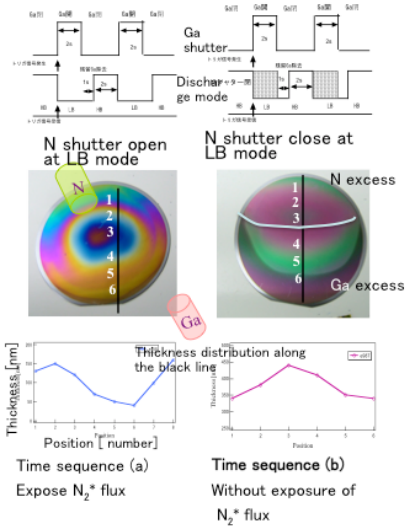

Fig. 1 Effect of N_2* flux exposure under AM-MEE.

References

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