ANNEALING EFFECT ON GaAs AND GaNAs NANOWIRES AT VARIOUS TEMPERATURES

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GaAs nanowires (NWs) are expected to be applied to next-generation optoelectronics. Besides, dilute nitride semiconductor GaNAs significantly reduces the band gap energy by a few percent of nitrogen introduction, is attracting attention for applications in semiconductor light sources in the telecommunications. Annealing is generally used to improve optical properties and reduce structural defects in GaNAs thin film grown at low temperatures and has been shown to be effective in NWs.[1] In this study, we investigate the effect of annealing temperature on the photoluminescence (PL) characteristics of GaAs and GaNAs-related NWs in detail, by varying the annealing temperature precisely.

Plain GaAs NWs and GaAs/GaNAs/GaAs core-multishell were grown on n-Si(111) substrates by molecular beam epitaxy (MBE). After the growth of the samples, annealing was performed in the MBE chamber under a high As overpressure for 1 hour. The annealing temperature was varied from 600°C to 850°C in 50°C increments. We carried out room temperature PL measurements comparing the samples before and after annealing at various temperatures (Fig. 1). For both the GaAs NWs and GaNAs NWs, the highest luminescence intensity was observed at the annealing temperature 700°C. The luminescence intensity tends to increase as the annealing temperature increases from 600°C to 700°C; the higher annealing temperature than 750°C drastically decreased the PL intensity. It is noteworthy that the PL intensity was increased concomitantly showing the spectral peak blueshift and the decrease of linewidth only for the GaNAs NWs, indicating the gradual termination of localized states.