

Abstract Submitted
for the MAR05 Meeting of
The American Physical Society

Higher external efficiency of LEDs having nano-structured surface fabricated by self-assembled block-copolymer AKIRA FUJIMOTO¹, KOJI ASAKAWA, Corporate Research & Development Center, Toshiba Corporation, 1, Komukai Toshiba-cho, Saiwai-ku, Kawasaki 212-8582, Japan — Recently, the internal quantum efficiency of LED has improved, but the external efficiency remains as low as a few % due to the high refractive index of semiconductors ($n=3-3.5$). In order to extract more light, a nano-pillar structure on the LED surface was fabricated. This structure has two functions; as an antireflective layer completely transmitting light below a critical angle to the LED surface, and as gratings that diffract the light larger than the critical angle to extract -1st order light. To fabricate this structure on the semiconductor (GaP) surface by dry etching, we employed a periodic dots pattern with self-assembled diblock-copolymer process. The diblock copolymer of polystyrene (PS) - polymethyl methacrylate (PMMA) was used in this study since the PMMA is etched much faster than the PS. The GaP was dry-etched by Cl-based inductively coupled plasma using the remaining PS dots as a mask, and the nano-pillars with a diameter of 100 nm, a period of 150-200 nm, and a height of 400 nm were fabricated. As a result, we improved the external extraction efficiency of the fabricated surface more than 100% compared with the flat one.

¹akira5.fujimoto@toshiba.co.jp

Akira Fujimoto
Corporate Research & Development Center, Toshiba Corporation

Date submitted: 04 Dec 2004

Electronic form version 1.4