

Wafer Scale Manufacturing Imprinter Using Flexible Mold

Hua Tan*¹, Lin Hu¹, Qi Zhang², and Stephen Y. Chou²

Nanonex Corporation¹
1 Deerpark Drive, Suite O
Monmouth Junction, NJ 08852

Princeton University²
Princeton, NJ USA 08540

*E-mail: htan@nanonex.com

Nano-patterning of sapphire is a key for GaN LED light extraction [1]. It is important to have a reliable equipment to carry out the nano-patterning processes to meet the large volume need of LED manufacturing.

In this paper, we present a high throughput imprint lithography tool for wafer scale patterning using soft mold technology. The machine is fully automatic with a 120 wafers per hour throughput. Cassettes of 3" sapphire wafers will be loaded into system and then transferred by robot into imprint chamber. ACP (Air Cushion Press) is then used to imprint a flexible mold on the wafer. After UV curing, the mold and wafer is separated automatically.

Sub-200 nm periodic patterns were successfully transferred to UV resists on sapphire surface over the entire wafer area under a low imprint pressure (a few PSI). Each imprint took only a few seconds. Pattern transferred were uniform as a result of ACP. Air bubbles were not observed in the imprinted pattern. The process was repeatable due to the fine control of the contact and separation of mold and substrate.

In addition to the patterning, soft mold can be fabricated inside the same imprint chamber. Meanwhile the fully automatic equipment is also capable of handling other substrates of different materials and sizes.

Reference:

[1] H. Chen, Q. Zhang, and S. Y. Chou, "Patterning of light-extraction nanostructures on sapphire substrates using nanoimprint and ICP etching with different masking materials," *Nanotechnology* 26 (8) DOI: 10.1088/0957-4484/26/8/085302 (2015).