

Development of UV-NIL Process and Tool for Flat Panel Displays

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Nanoimprint lithography (NIL) is an emerging method with a resolution of less than 10 nm, a high throughput, and low cost compared to conventional photolithography [1-2]. Although much research has examined NIL, most experiments have been performed in the laboratory and NIL is far from mass production. In an attempt to enable UV-NIL with a large-area stamp for high throughput, we propose a UV-NIL tool that can imprint Gen. 2 (370×470 mm) glass substrate in a low vacuum environment in a single step. A vacuum environment is used to ensure that no air bubble defects form during imprinting. The overlay becomes very critical as we start using very large stamps and substrates. Compared to a soft stamp made from polymer, a hard stamp made from quartz or glass can decrease misalignment error due to deformation and distortion of the stamp during loading and imprinting. The problem of release in large-area NIL devices is no less difficult than completely filling recessed patterns. For automatic release, compressed air is placed between the stamp and substrate. Release starts from the un-imprinted edge region. Figure 1 shows a schematic of the automatic release process and air-knife tool. Experimental results demonstrate the potential of our approach for low-cost lithography applicable to flat panel displays. (Figure 2)

- [1] Chou, S. Y., Krauss, P. R., and Renstrom, P. J., "Nanoimprint Lithography," *J. Vac. Sci. Technol. B*, Vol. 14, No. 6 pp.4129-4133, 1996.
- [2] Otto, M., Bender, M., Hadman, B., Spangenberg, B., and Kurz, H., "Characterization and Application of a UV-based Imprint Technique," *Microelectron. Eng.*, Vol. 57-58, pp. 361-366, 2001.

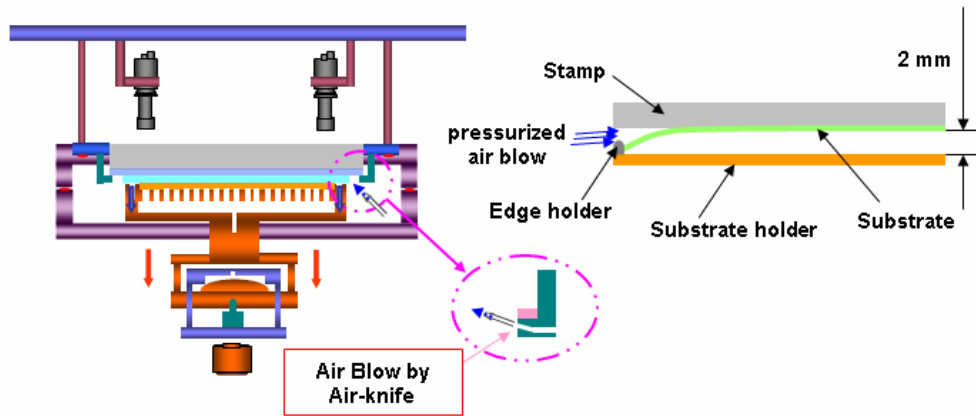


Fig 1: The operational principle of the proposed automatic release tool.

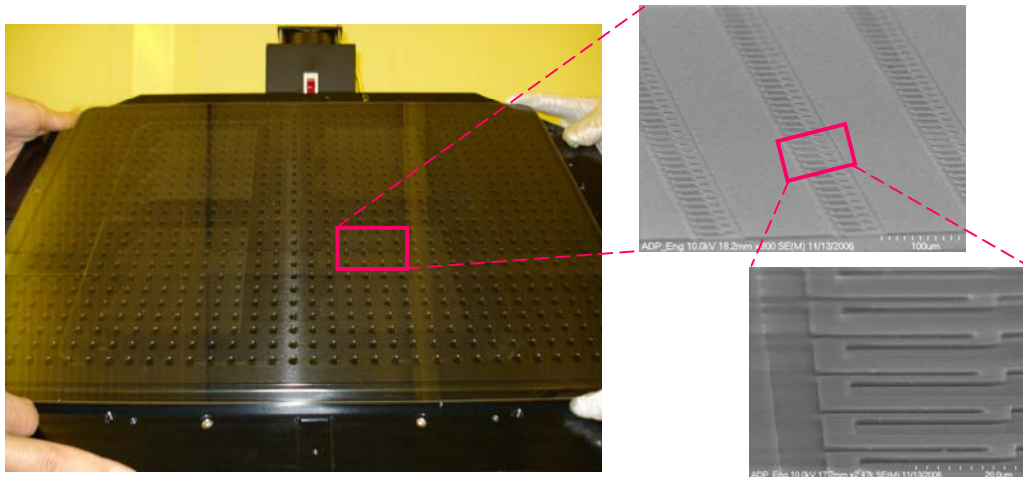


Fig 2: Micro-scale patterns were imprinted on very large area (370 by 470 mm) glass substrate using the developed UV-NIL tool. The height of imprinted pattern is about 1 μm and minimum line width is about 2 μm .