

Fabrication of large area (0.5m²) soft mold using roller pressing UV imprint machine

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In recently, Patterning method is spotlighted that patterns have a special features such as superhydrophobicity and superoleophobicity. Representative patterning methods are Nano Imprint Lithography and Photo Lithography. Nano Imprint Lithography, which applies resin and cures using heat or ultraviolet energy, has the advantage of being faster, simpler, and less costly than other patterning technologies. Therefore, this method is widely used and researches are actively proceeding such as Roll to roll imprint lithography.

We have studies the fabrication of large area soft molds required to apply UV Nano Imprint Lithography to Roll to roll equipment. For the large area soft mold, we used the step and repeat method, which is a method of continuous UV Imprint Lithography using small area mold and shadow mask to curing only pattern area.

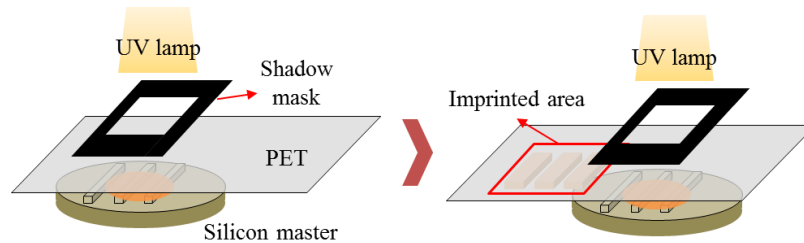


Figure 1. Step and repeat imprint method

A pillar pattern having a diameter of 260nm and a height of 520nm was used as a sub-master mold with 105×105 mm² patterned area. Because the sub-master pattern is pillar type, imprinted mold pattern has hole arrays as shown in Figure 2.

The shadow mask was applied to fit the pattern area and the step and repeat imprint was performed. After that, hand UV curing machine was used for resin curing. For the instance, the size of the large area soft mold is 105×945 mm² as shown in Figure 4. As a result, because of manual process, align error was appeared apparently.

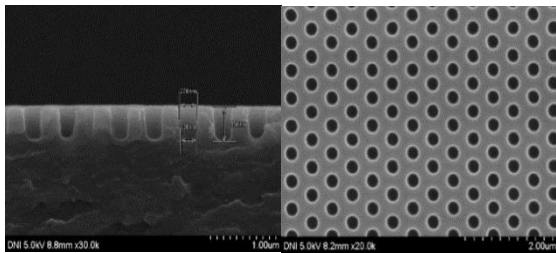


Figure 2. SEM images of Soft mold pattern

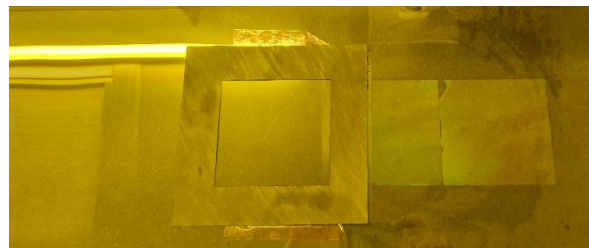


Figure 3. Schematic of step and repeat imprint

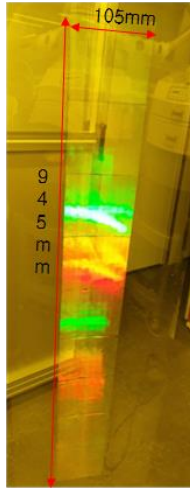


Figure 4. Large area mold

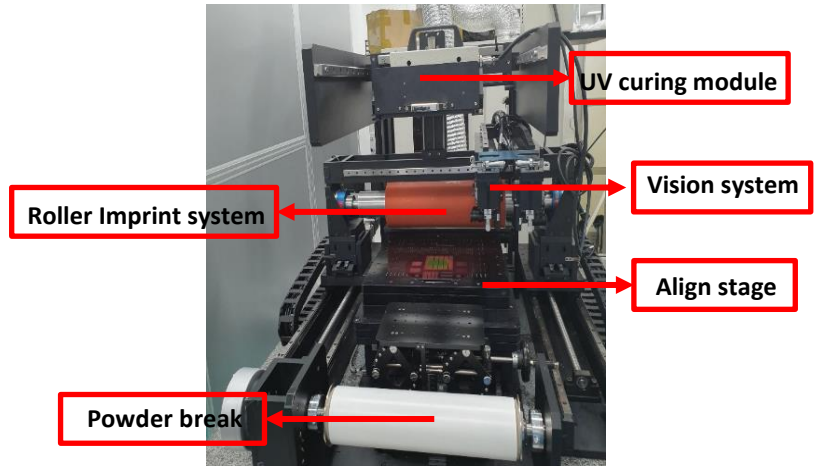


Figure 5. Step and repeat imprint equipment

In order to reduce the align errors, roller pressing and aligning equipment was designed and realized as shown in Figure 5. Using this machine, step and repeat imprint process was performed considering fine adjustment to minimize the align error. The equipment can be applied to uniform pressurization by load cell (Max. 1000N). So we have thought of using the above equipment to minimize the align error through the align camera using align mark, shown in Figure 9. Finally, the step and repeat imprint proceed as shown in Figure 9 with partial curing of the align mark using a shadow mask, and continuous imprint was made.

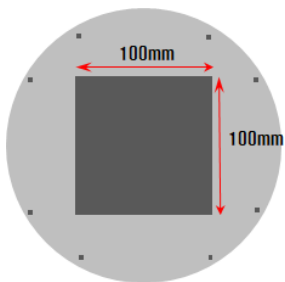


Figure 7. Master mold

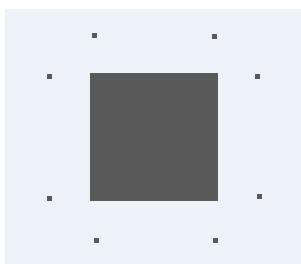


Figure 8. Sub-master mold

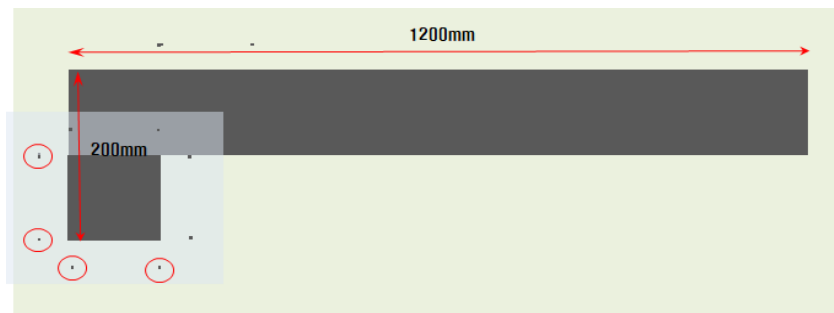
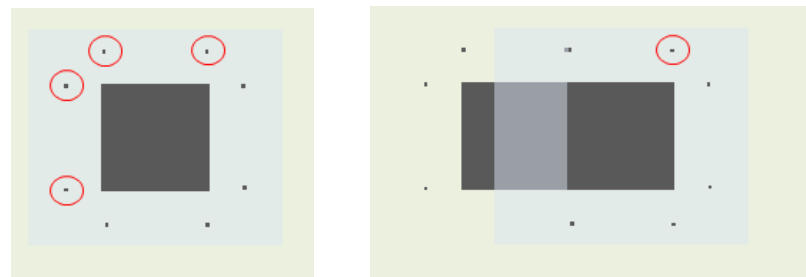


Figure 9. Step and repeat imprint with align mark

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