

## Novel 3D nanofabrication technique and its applications

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Nano transfer printing and micro contact printing is well known printing method based on soft lithography which uses conformal soft elastomer with designed surface relief structures. Here I introduce another class of novel 3D nanofabrication technique by using the same elastomer but in a different manner. The approach, which we refer to as proximity field nanopatterning, uses the surface-relieved elastomers as phase masks to pattern thick layers of transparent, photosensitive materials. Aspects of the optics, the materials, and the physical chemistry associated with this method are outlined. A range of 3D structures illustrate its capabilities, and several application examples demonstrate possible areas of use in technologies ranging from microfluidics to photonic materials to density gradient structures for chemical release and high-energy density science.

**Keywords:** soft lithography, 3D, nanofabrication

## 인쇄전자를 위한 롤투롤 프린팅 공정 장비 기술

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Manufacturing of printed electronics using printing technology has begun to get into the hot issue in many ways due to the low cost effectiveness to existing semi-conductor process. This technology with both low cost and high productivity, can be applied in the production of organic thin film transistor (OTFT), solar cell, radio frequency identification (RFID) tag, printed battery, E-paper, touch screen panel, black matrix for liquid crystal display (LCD), flexible display, and so forth. The emerging technology to manufacture the products in mass production is roll-to-roll printing technology which is a manufacturing method by printings of multi-layered patterns composed of semi-conductive, dielectric and conductive layers. In contrary to the conventional printing machines in which printing precision is about 50~100 $\mu$ m, the printing machines for printed electronics should have a precision under 30 $\mu$ m. In general, in order to implement printed electronics, narrow width and gap printing, register of multi-layer printing by several printing units, and printing accuracy of under 30 $\mu$ m are all required.

We developed the roll-to-roll printing equipment used for printed electronics, which is composed of un-winder, re-winder, tension measurement system, feeding units, dancer systems, guide unit, printing unit, vision system, dryer units, and various auxiliary devices. The equipment is designed based on cantilever type in which all rollers except printing ones have cantilever types, which could give more accurate machine precision as well as convenience for changing rollers and observing the process.

**Keywords:** Printed electronics, Roll-to-Roll, Printing, Low cost, High productivity