

Members' Profiles

Toshiba Machine Co., Ltd.

1. Company Profile

Founded as a machine tool manufacturer in 1938, Toshiba Machine has since developed and produced a wide variety of product lines in response to the demands of the times. Now operating as the Toshiba Machine Group, the company is involved in the production and sale of diverse equipment including injection molding machines, die-casting machines, plastic extrusion machines, industrial robots, nanoimprint machines, high-precision machines, machine tools, and hydraulic equipment.

2. Nanoimprint Machines

Toshiba Machine entered the field of nanoimprint machines in 2004 to develop and manufacture press-type and roll-to-roll nanoimprint machines. In 2009 the high-precision machine business was consolidated with a new Nano Processing System Division launched to synergize nanoimprint lithography with ultraprecision machining.

(1) Application of Nanoimprint Lithography to MEMS

While semiconductor integrated circuit and LIGA fabrication technologies are generally used when manufacturing MEMS, equipment and running costs for these processes rise sharply as the pattern size becomes smaller. Nanoimprint lithography is a simple process for transferring a mold pattern onto a substrate and is thought to have great potential for reducing MEMS fabrication costs.

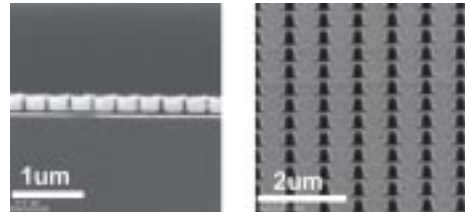
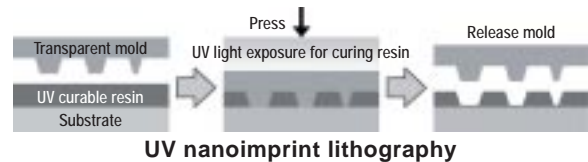
(2) Press-type Nanoimprint Machines

Toshiba Machine has developed a press-type nanoimprint machine (model No. ST50) with a maximum force of 50 kN. This machine supports UV imprinting, thermal imprinting, room-temperature imprinting, and micro-contact printing (soft lithography). Since it is necessary in nanoimprint lithography to provide flexible support for a wide variety of molds, patterns, and pattern-forming methods, we customize our machines for each customer to suit their desired imprint methods and mold structures.

A large number of the ST50 nanoimprint machines are being used in diverse research and development applications, including optical devices, storage media, biomedical applications, semiconductors, MEMS, and display devices. Recently we are developing nanoimprint machines capable of supporting mass production for such markets as high-brightness LEDs and discrete track media type hard disk drives.



Press-type
nanoimprint machine
ST50



Pattern transferred by a nanoimprint machine

(3) Roll-to-Roll Nanoimprint Machine

One obstacle in making nanoimprinting commercially viable is the need to support large-area applications. Toshiba Machine has developed and produced a roll-to-roll UV nanoimprint machine designed primarily for optical film applications. This machine applies the roll technology used in extrusion and printing systems, employing a gravure roll to mold UV curable resin coated on film. The applications of this machine are diverse and include optical sheets for flat-panel displays, biotechnological applications, solar cells, electronic paper, and wire-grid polarizers.



Roll-to-roll UV nanoimprint machine and transferred film

3. Toward the Mass Production of Nanodevices

Recently our customers' views toward nanoimprinting have changed from simply being content with good precision to wanting to perform prototype testing for the purpose of reducing costs in device mass production and enhancing the durability of the mold and mold-release layer. It is evident that the day is not far off when our system and machines will be used in production lines for a range of devices.

To realize device mass production with nanoimprint machines, it will be necessary not only to improve performance, but also to perfect the overall technology, including the mold, resin material, process design, and inspection required for implementing the entire manufacturing sequence. We are working tirelessly to develop these technologies as a total solution for our customers.