

**Imprinting with Revolving-belt
for Effective and Efficient
Replication of Microstructures**

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Rolling is one of the most efficient method for replication of microstructures. However, the contact between the master mold on the single roller and substrate is too brief, especially for resin requiring UV-curing. This paper proposes a novel method of imprinting with belt with microstructures revolving between two rollers for precision replication. The contact time between the master and the substrate is prolonged, starting from one roller through the flat belt to the other roller. This allows complete and precision replication, even allows abundant exposure to UV light for UV-curable resin coated on the substrate with master in contact. Furthermore, the fabrication of microstructures on a belt in the flat portion is much easier than fabrication on a roller in the curved surface.

In this study, a revolving belt system has been designed, constructed and tested. The experimental set-up is shown in Fig. 1. V-groove microstructures on the belt are successfully replicated onto the UV-curable resin coated on the substrate. Fig. 2(a) shows the SEM image of microstructures on the belt; Fig. 2(b) shows the replicated microstructures on the substrates. The microstructures are completely and precisely replicated.

This paper reports a novel revolving-belt type imprinting system for continuous replication of microstructures. As shown in Table 1, imprinting with revolving-belt combines the advantages of easy mold fabrication and long contact for UV-exposure in imprinting with plates and the advantages of short cycle time and continuous process in imprinting with rollers.

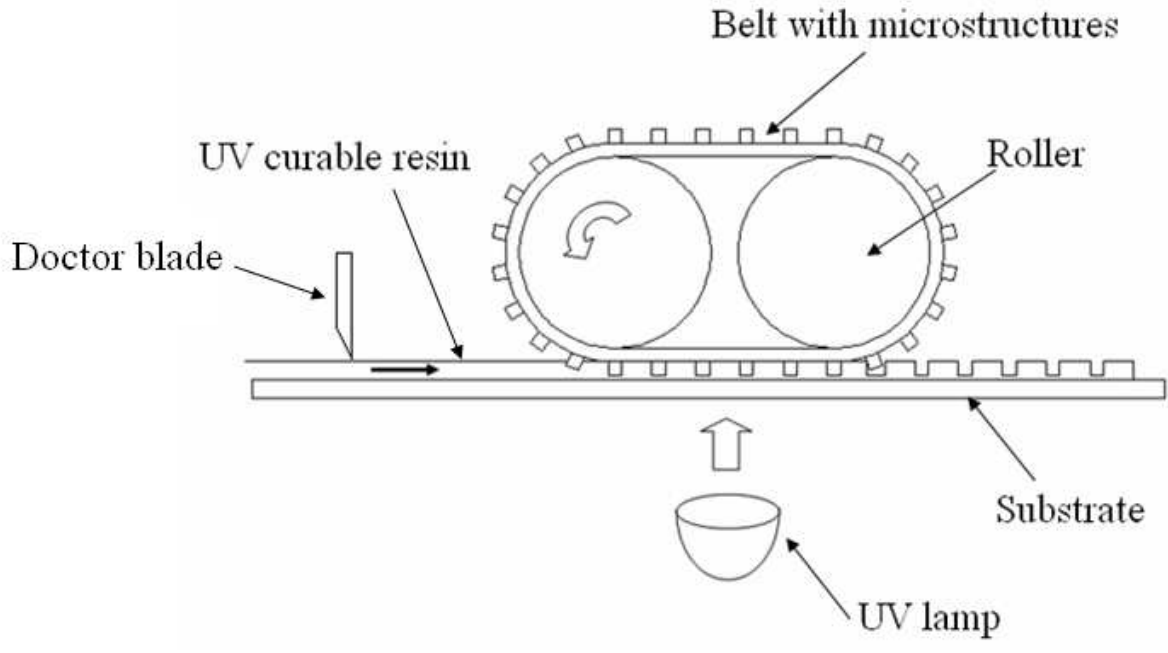


Fig.1 Schematic diagram showing microstructure replication system using revolving belt

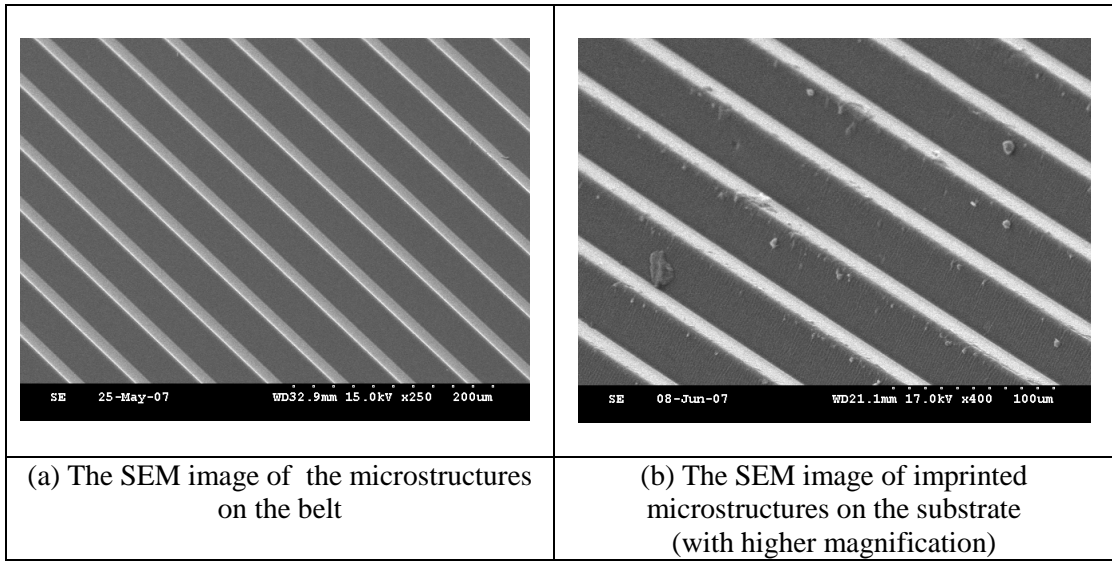


Fig.2 The SEM images of the microstructures on the belt and on the substrate

Table 1. Comparison of imprinting with revolving belt, with roller and with platens

| | Revolving-belt type | Roller type | Platen type |
|---------------------|---------------------|-------------|-------------|
| Efficiency | Good | Good | Poor |
| Cycle Time | Short | Short | Long |
| Mold Fabrication | Easy | Hard | Easy |
| Contact/UV-exposure | long | brief | Long |