MEMS 공정을 이용한 미세바늘 제조 및 성능평가
Micro-needle fabrication and Performance evaluation Using MEMS Process

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1. Introduction

Through oral medication and how medication directly through the syringe to the patient and the physician is still the most popular method. But in this method is have a not solving large problem. First that is waiting long medication effect time and second is on the skin the syringe needle insertion pain. These pain and reduced medications effect reaction time method is Use to Micro-needle. That is use to put on the affected or near of hurt area. Micro-needle is a simple and has not pain

These Micro-needles to create tiny hole on the skin that size very smaller than syringe needle. that is designed injection to medication without pain on epidermis or dermis in wide distribution nerve area . In addition, the hydrophilic polymer and the penetration of drugs through the skin, allowing drug delivery has emerged as an effective method using micro-needles. However, injection molding and conventional semiconductor processing to create through a micro-needle, once part of the price competitiveness of the micro-needle will be reduced.

In this paper, to solve these problems through a percutaneous micro-needle for drug injection method for fabrication the MEMS process and after the dicing process was created through a micro-needle, and then evaluate its performance compared with the existing production of cheaper and faster way Time production and a way to get high performance is proposed.

2. Fabrication Process

Micro needles are fabricated using UV lithography, dicing, nickel electroforming and injection molding.

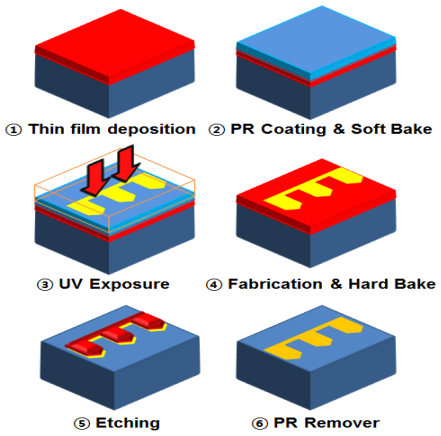

Fig. 1 MEMS Process

Fig. 1 show the micro needle fabrication process. As illustrated in Fig. 1 (2) PR coating (AR-N 4400 series PR), spin coater rotate 250~400rpm during 10s then 10~30 μm thickness PR coated. To hardening the PR, soft bake required at 85~95℃ about 1h. (3) UV masks aligned (EVG 6200 Mask aligner) with coated PR substrate, it was patterned Cr layer to define the shape of the micro needle, and Needle shape is form on the PR by UV lithography. (4) Before fabrication, to improve adhesive strength between PR and substrate and harden the PR, hard bake performed. The exposed photo resist removed by soaking in a developer (AZ MIF 300 Developer). (5) Deep reactive ion etching (DRIE) etched away silicon substrate. DRIE, PR acts as an etching mask.

(6) After etching, remained PR removal.

This process used in fabrication purpose for the positive micro needle and performed in dustless clean room. PR is a light-sensitive material, so this process performed to protect the light effect in yellow room.

3. Experiment

fabricated micro-needle as compared to the solid type, when the needle penetrate into skin of percutaneous insertion more effective on elastic and environment. if the needle to bend or damage to the human body can give you the breaks are made. To prevent this damage assessment was carried out the characteristics of the micro-needle.

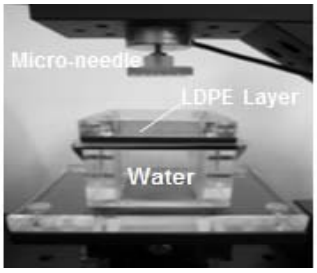

Fig. 2 Diffusion inspection module

With properties similar to human skin was used for LDPE. This experiment FIG. 2 experiments using a device such as diffusion device and put the water on the bottom of the cube and made a similar to human skin condition. The experimental conditions of the needle insertion speed 0.08mm / s at a rate of LDPE were inserted into the experimental results shown in Fig. 3

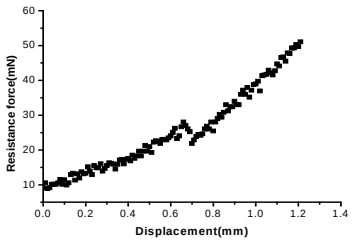

Fig. 3 Resistance force needle insertion into LDPE

4. Conclusion

Through this study, three-dimensional shape of the micro-needles fabricated by MEMS process and Dicing process and to evaluate the reliability of percutaneous needle-like conditions into the assessment of the LDPE was carried out.

Former fabrication process is expensive and need particular device. However, this process does not need any particular device, cheap, simple, and useful in mass production for micro-needle fabrication.

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