

Replication process for 3-D structure using PDMS mold

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This paper reports a research on the fabrication process to PDMS mold to turn into electroplating. Recently, downsizing and integration of the product is demanded. Shorter fabrication time of mold and cost down is demanded because the development cycle of the product is shorten. The mold supports Auto industry, electrical industry and machine industry. Generically, mold fabrication method employ machining process and electrical spark forming. But machining process need high cost and long fabrication time, electrical spark forming has difficult for fabricated to nano scale. For this reason this research paid attention to galvanofornung. Galvanofornung is used in electroplating. Electroplating has good shape replication characteristics, but this method has problem to long fabrication time. And so the purpose of this research is replication process using PDMS mold turn into electroplating.

Fabrication of 3-D structure use Synchrotron Radiation (SR) lithography. SR lithography has been recognized as the most efficient method for fabrication of high-aspect-ratio microstructure. 3-D structure fabricated by PCT (Plane-pattern to Cross-section Transfer) technique[1].

Fig.1 shows replication process of PDMS mold. First, defoaming in PDMS use vacuum oven. Second, casting to the PMMA master for PDMS and defoaming use vacuum oven. Next bake this sample to use oven. Third, PDMS mold fall away from PMMA master.

Fig.2 shows SEM images of PMMA master and PMDS mold. The shape was able to replication, but the dust is attached to PDMS mold surface. There are problem such as the spread of PDMS mold when PDMS mold fall away from PMMA master. Need to reorient of the Bake time and temperature to solve these problems and method to attach of the dust. Using microneedle array fabricated PDMS mold in Fig.3. In the same way, microneedle array was able to replication too and these PDMS mold be able to fabricate in only a day.

PDMS mold process to turn into electroplating can shortening of the process and cost down. As a future work, research of embossing for use PDMS mold and compare PDMS mold to PMMA master.

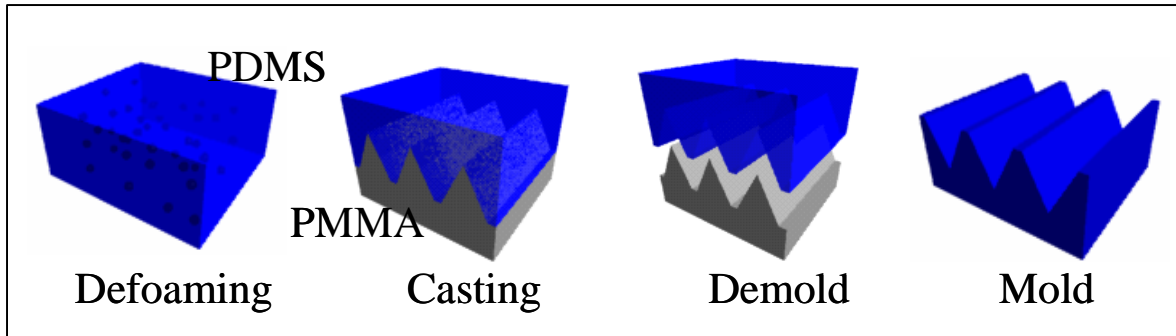


Fig.1 Replication process of PDMS mold

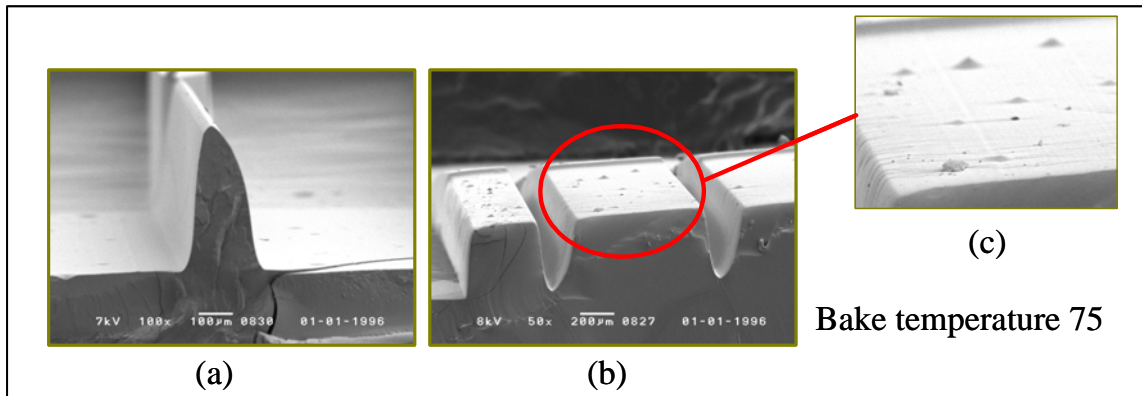


Fig.2 SEM images of PMMA master and PMDS mold, (a) 3-D structure by PCT, (b) PDMS mold and (c) surface roughness

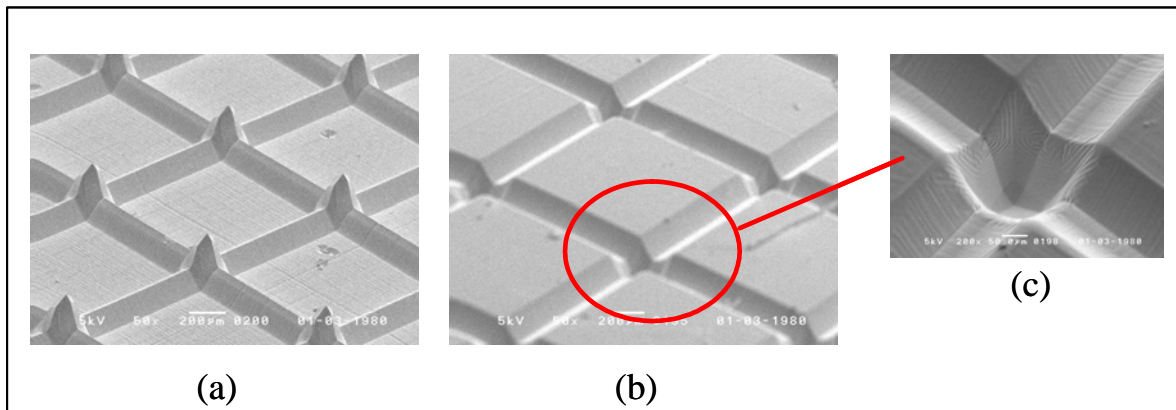


Fig.3 SEM images of PMMA master and PMDS mold, (a) microneedle array by PCT, (b) PDMS mold and (c) surface roughness

References

[1] S.Sugiyama et al, J Micromech. Microeng., 14,(2004) 1399