Micro patterning by thermal imprint technology using polymer stamp for PCB

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Recently, high performance microelectronic devices are designed in multi-layer structure in order to make dense wiring of metal conductors in compact size. This leads to a constant need to develop more highly integrated printed circuit board (PCB). Imprint technology have received significant attention due to an alternative technology for photolithography on such devices. Especially, thermal imprinting method for thermo-set materials was developed for micro patterning on PCB.

In this study, vacuum hydrolic pressure type imprinting system is used for the delivery of uniform pressing force. As the mostly well known thermo-set polymer composite, epoxy resins reinforced with silica (SiO_2) fillers were imprinted with polymer stamp.

In order to understand imprinting mechanism of the epoxy resins, the rheological behaviors such as viscosity changes at elevated temperature and time of the epoxy resins were observed using rheometer (ARES, TA, USA). All of imprinted patterns such as line, space, depth and via were analyzed with SEM (S3000N, Hitachi, Japan) and confocal microscope (NT1100D, Veeco, USA).

Polymer stamp patterns with the feature size ranging from 10 μm to 60 μm were successfully transferred into epoxy thermo-set resin with high fidelity. Copper electroplating is used for metallization on the imprinted patterns. Then excess copper layer removed using by mechanical and chemical methods. Compared to conventional patterning methods, thermal imprinting method is good candidate for micro patterning on PCB industry.

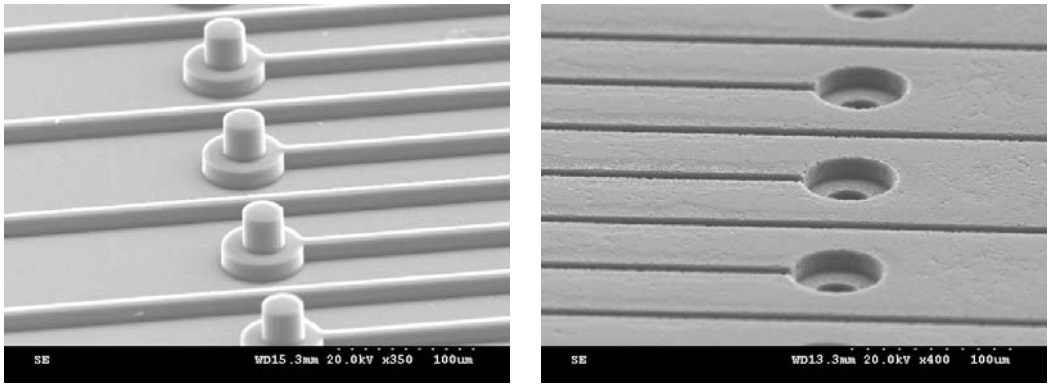

Fig 1: SEM images of the polymer stamp and imprinted epoxy patterns

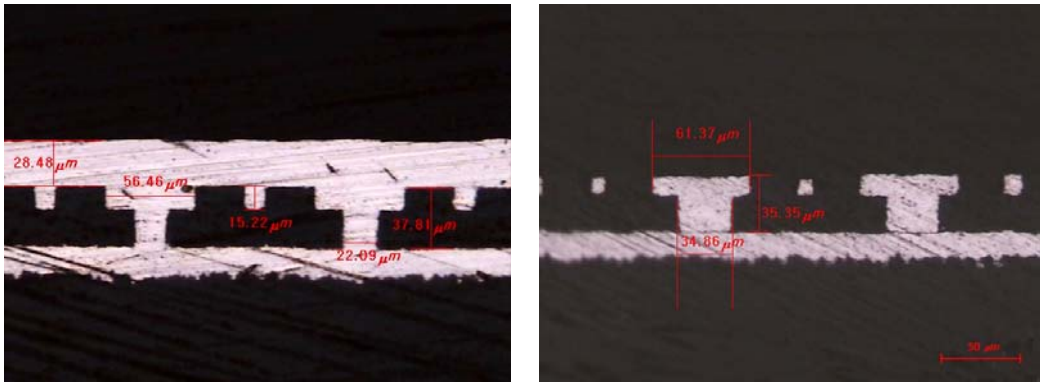

Fig 2: Cross-sectional optical micrograph of imprinted patterns after copper plating and planarization.

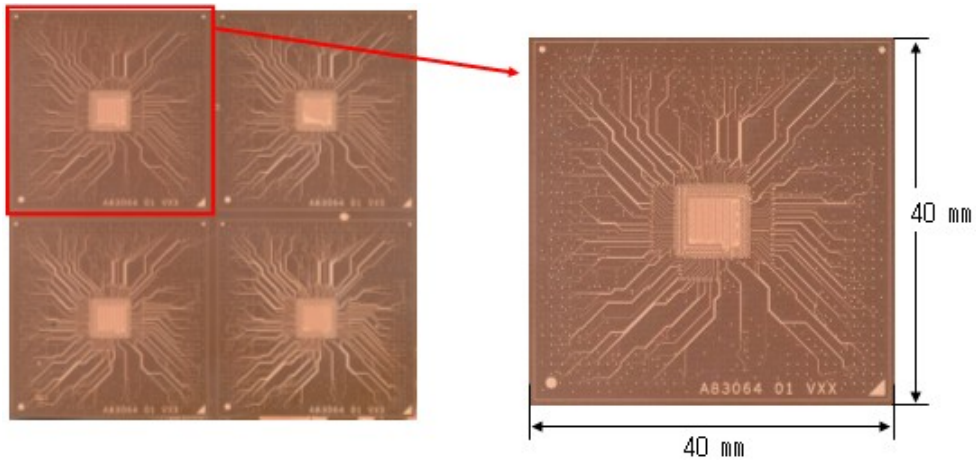

Fig 3: Photographs of FC-BGA patterns made by imprinting technology.