COST SAVINGS WITH MICRO/NANO-REPLICATION

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Micro/Nano-Replication technology, mostly known as Imprinting or Hot/Cold Embossing, offers a cost effective alternative to printing sub-100nm geometries when compared to the costly use of High Resolution Electron Beam lithography imaging.
With cost of paramount concern for many new bio and other fluidic applications, polymers are becoming one of the most practical materials for manufacturing. Several replicating techniques are used in the transfer of nano-scale images into a polymer layer. Embossing, stamping, imprinting and molding techniques are used, at wafer level, chip level or larger area level. Both single layer process and multi-layer process (with accurate overlay) are available, providing flexibility to the design engineer.

Just a few short years ago, micro and nano features seemed unrealistic for markets that demanded low cost production solutions. Today equipment is readily available that caters to the economic requirements for mass production using Micro/Nano-Replication. At wafer level, Cold Embossing is achievable with slight modifications to the proven contact printer aka (also known as) “mask aligner”. While Hot Embossing is achieved using a Substrate Bonder, designed to apply precise temperature and force. Both tools have been in use in the development and manufacturing of MEMS and have in applications, such as front–to-back alignment and packaging, enabled the technology. Machines developed for the extreme demand of placement accuracy i.e. optical communications (MOEMS) via device bonding / flip chip bonding are also capable and fully automated for both Cold and Hot Embossing processes.

This contribution will review the solutions available today, illustrated with applications of use, then discuss and examine the follow on evolution required to meet future requirements for nanoimprinting at both R&D and production levels.

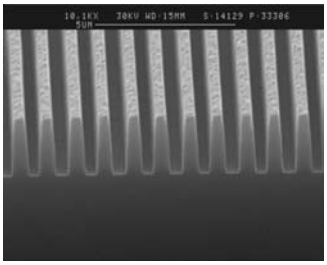

Fig. 1 Optical grating 1µm pitch aspect ratio 4:1 manufactured by cold embossing

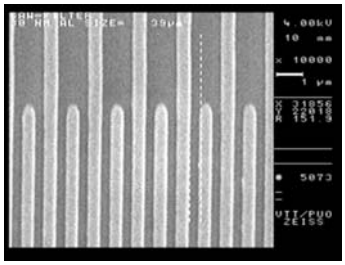

Fig. 2 400 nm structures manufactured by hot embossing