나노 사이즈 hot embossing 공정시 폴리머의 영향
Effect of polymer substrates on nano scale hot embossing

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Hot embossing has been widely accepted as an alternative to photolithography in generating patterns on polymeric substrates. The optimization of embossing process should be accomplished based on polymer substrate materials. In this paper, the effect of polymer substrates on nano scale hot embossing process was studied. Silicon molds with nano size patterns were fabricated by e-beam direct writing. Molds were coated with self-assembled monolayer (SAM) of (1, 1, 2, 2H -perfluorooctyl)-trichlorosilane to reduce the stiction between mold and substrates. For an embossing, pressure of 55, 75 bar, embossing time of 5 min and temperature of above transition temperature were performed. Polymethylmethacrylates (PMMA) with different molecular weights of 450,000 and 950,000, MR-I 8010 polymer (Micro Resist Technology) and polyaliphatic imide copolymer were applied for hot embossing process development in nano size. These polymers were spun coated on the Si wafer with the thickness between 150 and 200 nm. The nano size patterns obtained after hot embossing were observed and compared based on the polymer properties by scanning electron microscopy (SEM). The imprinting uniformity dependent on the pattern density and size was investigated.
Four polymers have been evaluated for the nanoimprint. By optimizing the process parameters, the four polymers lead to uniform imprint and good pattern profiles. A reduction in the friction for smooth surfaces during demoulding is possible by polymer selection.