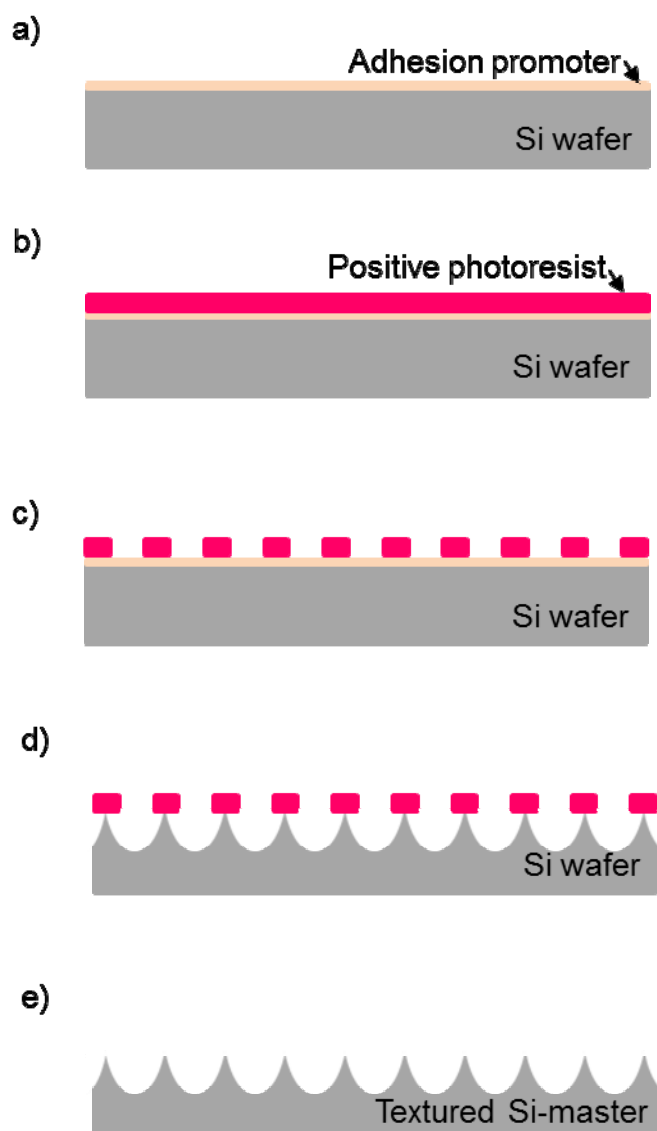


Fabrication of the textured Si-master

The process flow of the Si-master fabrication and imprint processes were shown in S1. A 6-inch Si wafer was cleaned in a piranha solution (a 3:1 mixture of 96 % sulfuric acid and 30 % hydrogen peroxide) at room temperature for 30 min, rinsed with deionized (DI) water and IPA to remove organic and inorganic impurities from the Si-wafer surface, and dried using N₂ gas (S1 (a)). Then, the dried Si-wafer was spin coated with HMDS and baked at 90 °C for 90 s to improve the PR adhesion to the oxidized Si wafer surface (S1 (b)). A commercially available PR, SS03A9, was spin coated at a rate of 4000 rpm for 30 s in order to obtain a thickness of approximately 1000 nm on the Si-wafer, and the quadratic patterns were prepared by a conventional photolithography method using a stepper (NSR2205i1 1D, Nikon) (S1 (c)). Subsequently, it was placed on the wafer holder of a mask aligner with a UV light in a MA 6 tool (Suss Microtech, Germany), exposed to 365 nm light (intensity of 20 mW/cm²) for 40 s in a non-contact mode, and screened by a quartz mask with feature sizes ranging from 500 nm to 1500 nm. Then, it was post-exposure baked at 110 °C for 90 s in order to elevate the hardening process, developed in NMD-3 for 60 s, and hard baked at 120 °C for 90 s (S1 (d)). Afterwards, the photo-patterned Si-wafer was etched via reactive ion etch (RIE) using SF₆/O₂ plasma. The remaining PR on the Si wafer was stripped through an O₂ plasma treatment. Finally, the textured Si-masters with three different profiles of the depth in 500 nm, 650 nm, and 1000 nm were obtained.



S1. A schematic diagram of the overall processes flow for fabricating the textured Si-master using a conventional photolithography method. a) A cleaned Si wafer is surface treated using HMDS as an adhesion promoter. b) Positive photoresist (PR, SS03A9) is spin coated on the HMDS treated Si-wafer. c) PR layer is photo-patterned using Stepper, UV-exposed with 20 mW/cm^2 for 40 s, post-exposure baked at 110°C for 90 s, developed in NMD-3 for 60 s, and hard baked at 120°C for 90 s. d) The photo-patterned Si-wafer is etched via photomask by reactive ion etching (RIE) process using SF_6/O_2 plasma. e) The remaining PR on the Si wafer was stripped by an O_2 plasma treatment and finally the textured Si-master is obtained with three different height profiles of 500 nm, 650 nm, and 1000 nm, respectively.