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**A self-aligning microtensile setup: application to single crystal GaAs microscale tension-compression asymmetry**

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***Supporting Information***

*S1: Silicon Etching*

Czochralski-grown <100> orientation single crystal Si substrates with a diameter of 100 mm and a thickness of 525 µm were used for the fabrication of tensile grippers. The wafers were ground with a Disco DAG810 (DISCO Corporation, Japan) automated surface grinder down to a thickness of 200 µm. The substrates were spin coated with AZ 9211 photoresist (Microchemicals GmbH, Germany) at 1900 RPM to obtain an 8 µm thick coating. The gripper patterns were exposed in a direct laser writer (MLA 150, Heidelberg Instruments, Germany) at a 405 nm wavelength, 180 mJ/cm2 dose and 1µm spot size. The wafers were subsequently hard baked at 85°C for 4 hours. The pattern was transferred into the silicon with the Bosch dry etch process in an Alcatel AMS200SE (Alcatel Micro Machining Systems, France) plasma etcher. 300 sccm SF6 and 150 sccm C4F8 gases were interchanged at 1800 W ICP plasma, for silicon etching and sidewall passivation, respectively. With these settings, an etch rate of 4.75 µm/min is achieved. The etching process was stopped when a 195 µm etch depth was reached. The photoresist layer was removed by an O2 plasma in a Tepla Gigabatch (Tepla Gigabatch, USA) barrel stripper, and the fluorocarbon contamination from the silicon etch process was cleared by a full RCA cleaning cycle. The alternating etch steps result in a scalloped sidewall profile with a typical step width of 200 nm and a height of 600 nm. To reduce the scalloping down to 20 nm steps, a 2 µm thick thermal oxide layer was grown onto the substrate in a Centrotherm (Centrotherm, Germany) furnace. The latter smoothens the sidewalls by consuming silicon. This oxide film was etched away via immersion in an HF solution. The etched substrate was glued with the bottom side upwards onto a carrier wafer. An isotropic dry etch process, where SF6 and C4F8 are released simultaneously into the plasma, was used to separate the silicon grippers from the substrate.

*S2: LIGA process for Nickel Grippers*

Single crystal silicon wafers (100) with a diameter of 100 mm and a thickness of 525 μm were coated with 5 nm chromium and 100 nm gold layers by means of thermal evaporation. To improve polymer adhesion, a dehydration process at 160°C for 10 minutes was executed prior to spin coating. High viscosity SU-8 (GM 1075, Gersteltec Sarl, Switzerland) was coated onto the substrates at 1250 RPM for 45 seconds. The wafers were placed in a closed container at 40°C for 3 hours for stress relaxation and to ensure coating uniformity. The substrates' temperature was increased by 3°C/min to 120°C and the mould was baked until solidified for 30 minutes. The gripper patterns were exposed using a Karl Suss MA6 (SUSS MicroTec, Germany) contact aligner by bringing the substrate into vacuum contact with a soda lime mask plate. The exposure light source was filtered for the 365 nm i-line and irradiated the polymer for 52 seconds with 8 mW/cm2 intensity, selectively cross-linking the polymer mould. The mask was patterned with a direct laser writer (Heidelberg VPG200, Heidelberg Instruments, Germany), and the chrome layer on the mask was etched using an automated Hamatech mask processor (HamaTech AG, Germany). The post-exposure bake was ramped to 90°C at 1.4°C/min. After one hour of baking, the substrate was cooled to room temperature at a low rate of 0.75°C/min, to decrease stress build-up caused by cross-linking induced density change. Dissolution of the unexposed SU-8 was performed via immersion into PGMEA (Sigma Aldrich, USA) for a duration of 10 minutes. The wafers were then rinsed in isopropanol (Sigma Aldrich, USA) and were left in air to dry.

The nanocrystalline nickel (nc-Ni) electrodeposition was performed in a two-electrode setup with the patterned gold wafer, as the working electrode, and a soluble Ni counter electrode. The 150 μm grippers were deposited from commercial Ni sulfamate electrolyte (DOW Chemicals®, Switzerland) with a Ni contents of 159 g/l. Commercial additives PC-3 and Wetting agent "W" (DOW Chemicals®, Switzerland) were added to the bath at a concentration of 0.12 g/l and 0.14 g/l per liter, respectively. Prior to the deposition, the pH of the electrolyte was adjusted to pH 4 with 1 M sulfamic acid. The deposition was carried out for 2 hours and 55 min at 55°C with a current density of 4.5 A/dm2. Subsequently, the overgrowth was removed on a lapping plate using both 6 µm and 3 µm particle diameter solutions (LamPlan®, France). The SU-8 photoresist was removed in a 900 W O2/CF4/N2 plasma at 60°C for 2 hours using a Muegge MA3000D system (MUEGGE GmbH, Germany). Finally, the wafer was dissolved in 5 M KOH solution at 50°C and the chromium was removed from the specimen by 2 M KMnO4 solution.