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| Objective |
| Batch name: Process flow fabrication of surfaces |
| |  | | --- | | This is a process flow to be used for the formation of some silicon wafers with different micropatterns for testing purposes and a final nikkel shim for injection molding. The processes will be lithography (Spin-coating, Deep-UV lithography with maskless aligner), dry etching, oxygen plasma ashing, thin film deposition of NiVd, Ni-electroplating and KOH wet etching. Thin layer of FDTS and afterwards injection molding.  If allowed use of IBE for thin film deposition of TiO2. (for polymers after injection molding outside clean room).  Characterization with Sensofar and SEM will be performed post- lithography, post-oxygen plasma ashing and post KOH etching. Last step will be the wettability measurement with the contact angle goniometer for measuring hydrophilic and hydrophobic surfaces. | |

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| Substrates | | | | | | | | | | |
| Substrate | Orient. | Size | | Doping/type | Polish | thickness | Box | Purpose | # | Sample ID |
| Silicon | <100> | | 4” | n(Phosphor.) | SSP | 525±25µm | TN574 | Device wafers | 10 | S1-S10 |
| Silicon | <100> | | 4” | n(Phosphor) | SSP | 525±25µm |  | Test wafers | 1 | T1 |

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|  | Wet etching KOH | 5.1 |  |
|  | FDTS Layer/ MVD | 6.1 |  |
|  | PMMA/ or injection molding of other polymers | 7.1 |  |
|  | Thin film deposition of TiO2 /IBE- IBSD Ionfab 300 | 8.1 |  |

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| Step Heading | Equipment | Procedure | Comments |
| 1. Preparation | | | **All wafers** |
| * 1. Wafer selection | Wafer box | Take the wafers from the storage and put them in a wafer box. | Note the wafer IDs in the batch traveler |
| 1. Lithography | | | **All wafers** |
| * 1. Clean spinner | Spin Coater: Gamma UV | Check nozzle and run the dummy wafers:  3411 DCH 100mm 5214E 1.5um HMDS  Or only to clean **3410 DCH 100mm 5214E 1.5um** | 1-2 dummies |
| * 1. Coat wafers | Spin Coater: Gamma UV | Coat the device wafers using recipe:  3411 DCH 100mm 5214E 1.5um HMDS  clean machine:  (0400) DCH 100mm Coater Clean | AZ5214E standard positive resist Thickness 1.5 µm |
| * 1. Exposure | Aligner: Maskless 02 (MLA2) | Recipe:  Exposure wavelength: 375nm  Exposure dose: 65 mJ/cm2  Defocus: auto adjustment | Not sure the difference of the quality exposure |
| * 1. Develop | Developer:  TMAH UV-lithography | No PEB  Development in TMAH: SP 60s  Sequence: 1002 DCH 100mm SP 60s | No post exposure bake single puddle (SP) |
| * 1. Dry | Spin dryer | Spin dry |  |
| * 1. Inspection | Optical microscope | Check pattern and alignment marks or IDs |  |
| 1. Dry etching DRIE- Pegasus | | | **1 wafer at a time** |
| * 1. Dry etch | Pegasus 1 | Recipe: Process D-4 (PrD-4)  Coil power: 2500 W Platen power: 35 W SF6:275 sccm O2: 5 sccm  Time: 42 cycles or 2.3 min (for 5 µm depth)  84 cycle or 4.6 min (for 10 µm depth) | Different etch depths  5µm, 10 µm and 20 µm,  Trench diameter 10µm  **Aspect ratio depended etching (ARDE)**  **Expected error ±2µm** |
| * 1. Plasma Ashing | Plasma asher | Recipe: -Duration: 15-25 min  -pressure 0.8- 1.2mbar  -O2: 400 sccm  -N2: 0-70 sccm -Power: 1000 W | Stripping of 1.5 µm AZ5214e resist is 15-25 min |
| * 1. Inspection | SEnsofar/ SEM | Check pattern and alignment marks at Sensofar or SEM |  |
| 1. Ni electroforming | | | **2 wafers** |
| * 1. NiV alloy thin film | Lesker | Edit and embed the recipe in the “DC stack recipe” (primary recipe).  Modifications:  • Deposition rate: ~5 nm/min (0.085 nm/sec)  • Duration: 1000 sec. (~85 nm)  • Duration: 1200 sec. (~100 nm) | Nickel vanadium thin film |
| * 1. Electroforming | Ni Electroplating | Mount the wafer in the electrode assembly and  run the recipe.  Recipe: 0-9 DCH6\_40.5Ah\_7h  Duration: 7 hours 13 min 36 sec.  Thickness: ~350 μm | Note: If the contact ring is dirty, clean it in dilute nitric acid solution in Fume hood 06: Si Etch. |
| 1. KOH etching | | |  |
| * 1. Wet Etch | Si etch 3:KOH | Etchant: KOH solution (28 wt%) in H2O.  Temperature: 80 °C | In Fume hood 06: Si Etch.  Etch rate:1.22 μm/min at 80 °C.  Estimated etch time:  9 hours 13 min. |
| * 1. Inspection | Optical Sensofar/SEM Supra 2 | Inspect the Ni shim Check structure, patterns and depths. | Measure heights and widths |
| 1. Anti-stiction coating | | |  |
| * 1. Deposition of FDTS | MVD | Preparation recipe: **COLDPREP2**  Process time: 10 min  Recipe: **STAMP2**  Process time:80 min | Injection of FDTS |
| 1. Polymer injection molding | | | |
| * 1. PMMA | Engel Victory Tech 80/45 | Drying process: PMMA (LG IG840)  Temperature: 75°C  Drying time: 5 hours program 4  Microscope slide | The total thickness of the nickel shim and the back plate must be 1,32-1,35 mm  Check manual of injection molder  Different polymers (PP, PE, etc) |
| * 1. Cleaning with soap sonic | Triton X-100 and sonication in gowning area | Cleaning of polymer samples that have been out of the cleanroom.  Add 20 - 30 drops of diluted Triton X-100 detergent. | PMMA, PP (melting point 160 °C), PE (135° C)  Dimensions (microscope slide standard dimensions (25 mm width, 75 mm length) |
| 1. Thin film deposition/Deposition of Titanium Oxide/IBSD of TiO2 | | |  |
| * 1. Deposition of of TiO2 | IBE/IBSD ionfab 300 | Recipe: standard recipe 1 Process time: 52 min  Platen angle: 52°  Thickness: ~180 nm | This thin film might be deposited on different polymers from outside cleanroom.  Have to check the cross contamination. |
| 1. Characterization | | |  |
| * 1. Optical Inspection | Nikon ECLIPSE L200 | Measure widths and check |  |
| * 1. Profilometry | Sensofar | 3 D structures and depth profiles |  |
| * 1. SEM inspection | SEM-Supra 1 | Measure widths, depth |  |
| * 1. Wettability | Contact angle goniometer | Measure contact angle for hydrophilic or hydrophobic surfaces | After deposition of thin film |

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