BioMEMSPhotomask Aligner

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Function: An aligner is desired that will hold the master and photomask in place aligning the layers between 10- 100 um resolution. This aligner may or may not utilize a microscope to assist inaligning. Many commercially available aligners are available, however, they are extremely expensive and over complicated. The aligner would be used primarily for teaching purposes. If a successful prototype can be made under specifications, a manual for building and using future aligners could be written and published.

Client requirements:

- Maintain a budget of under $200

Design requirements:

- Aligner must be compatible with both 3 in. and 6 in. sizes of silicon wafers and masks
- Alignment accuracy desired to be 10μm, with a realistic target of 100μm

1. Physical and Operational Characteristics

a. *Performance requirements*:

- Aligner will be used multiple times per week, generally by experienced graduate students and professors
- Can be exposed to UV light on regular basis depending on design solution

b. *Safety*:

- Be aware of UV light exposure and any warnings on epoxies used on silicon wafers
- Be aware of any burrs on the screws

c. *Accuracy and Reliability*:

- Consecutive layers will ideally be positioned within 10-100 microns of accuracy
- Precise alignment must be repeatable every time device is used

 d. *Life in Service*:

- 5 years of use in research lab on daily to weekly basis

e. *Operating Environment*:

- Prolonged exposure to UV light, depending upon design
    - Each usage includes exposure to UV light at 350-400nm for 30-60 seconds
- Storage environment is standard room temperature lab

f. *Ergonomics*:

- When using a microscope for alignment, a glare from the light may inhibit ability to align the photomask
- Simple user-product interface

g. *Size*:

- Should be compatible with 3 and 6in disks, therefore not exceeding a 1ft^3 volume
    - 3in wafers ordered from WRS Materials (current vendor) have a diametric tolerance ±300µm with flat location on <110> plane ±1 degree and flat length of 22.22±3.17mm
    - 6in wafers ordered from WRS Materials (current vendor) have a diametric tolerance ±200µmwith flat location on <110> plane ±1 degreeand flat length of 57.5±2.5mm
- The device will be portable so as to be used in various labs

h. *Weight*:

- Not to exceed 10 pounds in total weight

i. *Materials*:

- Materials must cost under $200
- Materials used in procedure include SU-8 100 epoxy (from MicroChem Corp.)

j. *Aesthetics*, *Appearance, and Finish*:

- Aligner should appear professionally finished

2.Production Characteristics

a. *Quantity*:

- One unit with potential future manual for DIY construction

b*. Target Product Cost*:

- Under $200, as current photomask aligners are significantly more expensive

3. Miscellaneous

a. *StandardsandSpecifications*:

- Must be usable in a teaching lab

b. *User concerns*:

- Easy to train new users on aligner

- Trouble shooting should not require any advanced knowledge of the design

c. *Competition*:

- Current devices do exist and are exceptionally expensive, but we have not performed an extensive literature search