Etch

Last updated 3/5/19

Etch

- Etching
  - The process of removing material
  - Used in semiconductor processing to remove
    - Si
    - SiO_2
    - Poysilicon
    - Metal
    - …
  - Two primary approaches
    - Wet etching
    - Dry (Plasma) etching

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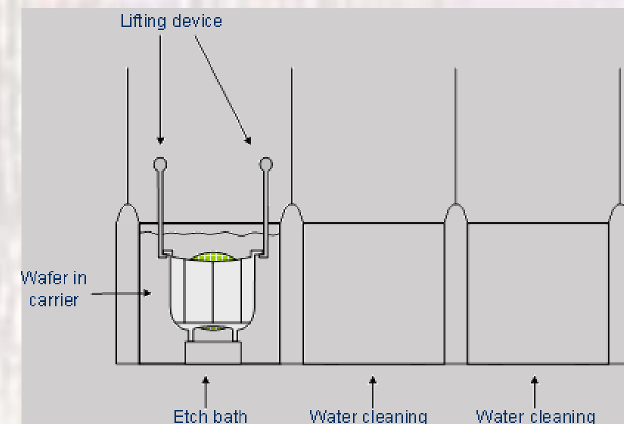
Etch

- Wet Etch
  - Use liquid chemicals to remove the desired material
    - Present a liquid etchant to the material to be etched
    - A chemical reaction occurs that removes a portion of the unwanted material
    - Removal of the unwanted byproducts
  - Etch SiO_2

    $SiO_2 + 6HF \dashrightarrow H_2SiF_6 + H_2O$ where H_2SiF_6 is water soluble
  - Carefully time the etch process to ensure the desired thickness of material is removed



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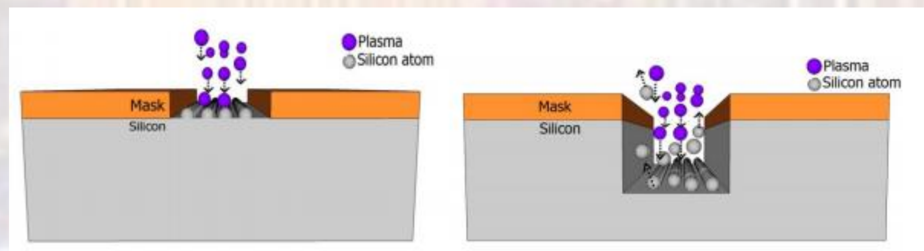
Etch

- Dry (Plasma) Etch
  - Use gas or plasma to remove the desired material
  - Three approaches
    - Physical
      - No chemical reaction
      - High energy particles physically knock atoms off the surface



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    - Chemical Dry
      - Similar to wet etching but using gases instead of liquids

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Etch

- Dry (Plasma) Etch
  - Three approaches –cont'd
    - Reactive ION
      - Enhances Chemical etching with Physical etching
      - Most controllable approach
        - Modify the ion energy
        - Modify the amount of reactants

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Etch

- Etching Concerns
  - Etch rates depend on more than just the etching material
    - Etched material orientation – lattice structure
    - Surface features
  - Isotropic – etches the same in all directions
    - Common with wet etching
  - Anisotropic – has a highly desired etch direction
    - Driver for Dry and RIE

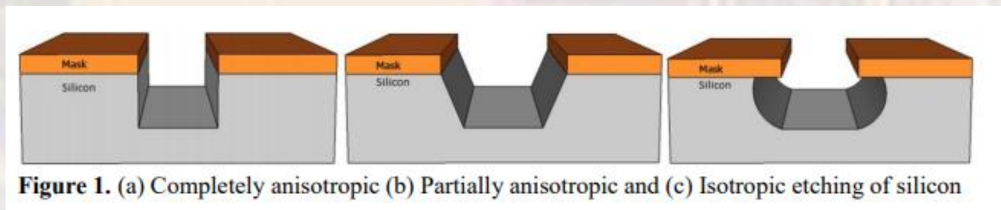

Figure 1. (a) Completely anisotropic (b) Partially anisotropic and (c) Isotropic etching of silicon

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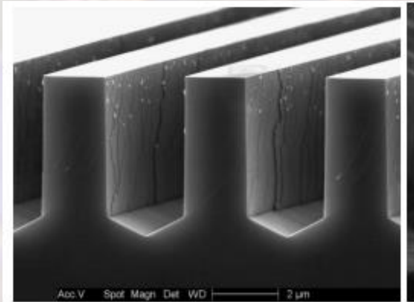
Etch

- Examples



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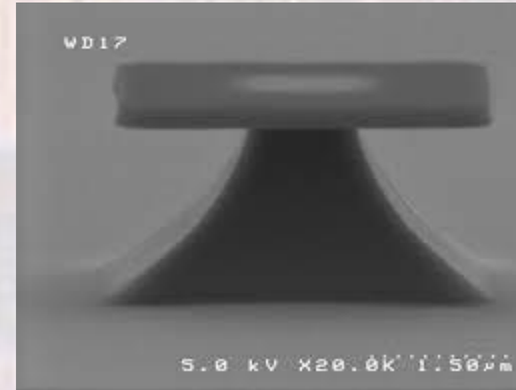

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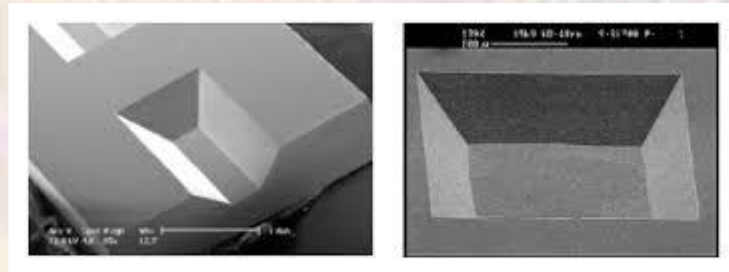

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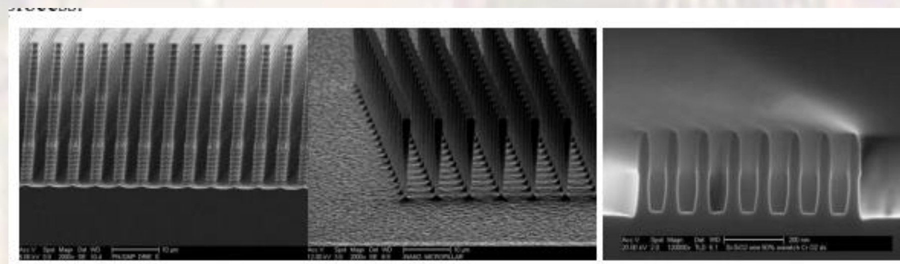

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