Wet Etching Recipes

From UCSB Nanofab Wiki

See the Master Wet Etching Table (https://www.nanotech.ucsb.edu/wiki/index.php/Wet_Etching_Recipes#The_Master_Table_of_Wet_Etching_.28Include_All_Materials.29) at the bottom of this page for wet-etch rates in various experiments we have tested.

Contents

References

1. Etch rates for Micromachining Processing (IEEE Jnl. MEMS, 1996) (http://ieeexplore.ieee.org/abstract/document/546406/) - includes tables of etch rates of numerous metals vs. various wet and dry etchants.
2. Etch rates for micromachining-Part II (IEEE Jnl. MEMS, 2003) (http://ieeexplore.ieee.org/abstract/document/1257354/) - expanded tables containing resists, dielectrics, metals and semiconductors vs. many wet etch chemicals.
3. Guide to references on III±V semiconductor chemical etching (http://www.sciencedirect.com/science/article/pii/S0927796X00000279) - exhaustive list of wet etchants for etching various semiconductors, including selective etches.
4. Transene's Chemical Compatibility Chart (http://transene.com/etch-compatibility/) provides a useful quick-reference for which Transene etchants attack which materials.
    1. As a side-note, Transene (http://transene.com/) provides many pre-mixed solutions that you can order, saving you the time and uncertainty of measuring/mixing such chemicals yourself. Make sure you check with us before ordering so we know how to handle the chemical before it arrives.

Compound Semiconductor Etching

Guide to references on III±V semiconductor chemical etching (http://www.sciencedirect.com/science/article/pii/S0927796X00000279)

Please add any confirmed etches from this reference to the The Master Table of Wet Etching (Include All Materials).

Metal Etching

- Selective Wet Etch of Cr over Ta using Cr Etchant
- Wet Etch of ITO using Heated, Diluted HCl Solution

Silicon etching

Etch rates for micromachining processing (http://ieeexplore.ieee.org/xpls/abs_all.jsp?arnumber=546406)

Etch rates for micromachining processing-part II (http://ieeexplore.ieee.org/xpls/abs_all.jsp?arnumber=1257354)

Please add any confirmed etches from this reference to the The Master Table of Wet Etching (Include All Materials).

Dielectric etching

Organic removal

Gold Plating

Chemi-Mechanical Polishing (CMP)

Example Wet Etching Table

How to use the Master Table of Wet Etching:

When entering a new etch into the table make a row for every etchant used in the solution such that the information can be sorted by etchant. For example, the InP etch HCl:H3PO4(1:3) and H3PO4:HCl(3:1). Likewise, if etch is known to be selective to multiple materials the etch should have a row for each material. For example HCl:H3PO4(1:3) is selective to both InGaAs and InGaAsP.

This multiple entry method may seem laborious for the person entering a new etch, however the power of sorting by selective materials and chemicals in a table with all materials is great.

Material	Etchant	Rate (nm/min)	Anisotropy	Selective to	Selectivity	Ref.	Notes	Confirmed by	Extra column
InP	HCl:H3PO4(1:3)	~1000	Highly	InGaAs	High	Lamponi (p.102) (http://tel.archives-ouvertes.fr/docs/00/76/94/02/PDF/VA2_LAMPONI_MARCO_15032012.pdf)	Example	Jon Doe	Example
InP	HCl:H3PO4(1:3)	~1000	Highly	InGaAsP	High	Lamponi (p.102) (http://tel.archives-ouvertes.fr/docs/00/76/94/02/PDF/VA2_LAMPONI_MARCO_15032012.pdf)	Example	Jon Doe	Example
InP	H3PO4:HCl(3:1)	~1000	Highly	InGaAs	High	Lamponi (p.102) (http://tel.archives-ouvertes.fr/docs/00/76/94/02/PDF/VA2_LAMPONI_MARCO_15032012.pdf)	Example	Jon Doe	Example
InP	H3PO4:HCl(3:1)	~1000	Highly	InGaAsP	High	Lamponi (p.102) (http://tel.archives-ouvertes.fr/docs/00/76/94/02/PDF/VA2_LAMPONI_MARCO_15032012.pdf)	Example	Jon Doe	Example

The Master Table of Wet Etching (Include All Materials)

Use the ↑↓ Arrows in the header row to sort the entire table by material, selectivity, etchant etc.

Material	**Etchant**	**Rate (nm/min)**	**Anisotropy**	**Selective to**	**Selectivity**	**Ref.**	**Notes**	**Confirmed by**	**Extra Notes**
InP	HCl:H3PO4 (1:3)	~1000	Highly	InGaAs	High	Lamponi (p.102) (http://tel.archives-ouvertes.fr/docs/00/76/94/02/PDF/VA2_LAMPONI_MARCO_15032012.pdf)	Example	Jon Doe	Example
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Al2O3 *(ALD Plasma 300C)*	Developer: 300MIF	~1.6	None	Most non-Al Materials.	High	Measured in-house	Rate slows with time.	JTB	Example
Al2O3 *(ALD Plasma 300C)*	Developer: 400K	~2.2	None	Most non-Al Materials.	High	Measured in-house	Rate slows with time.	JTB	Example
Al2O3 *(ALD Plasma 300C)*	Developer: 400K (1:4)	~1.6	None	Most non-Al Materials.	High	Measured in-house	Rate slows with time.	JTB	Example
Al2O3 *(ALD Plasma 300C)*	NH4OH:H2O2:H2O (1:2:50)	~<0.5				Measured in-house	Rate slows with time	JTB	Example
Al2O3 *(IBD)* (https://www.nanotech.ucsb.edu/wiki/index.php/Sputtering_Recipes#Al2O3_deposition_.28IBD.29)	HF ("Buffered HF Improved", Transene)	~170	None	Photoresist	High	Measured in-house	May need to increase adhesion with thin SiO2 layer, and 100°C baked HMDS.	Biljana Stamenic	2017-12
Al2O3 *(IBD)* (https://www.nanotech.ucsb.edu/wiki/index.php/Sputtering_Recipes#Al2O3_deposition_.28IBD.29)	Developer: 726 MiF	3.5	None	Most non-Al Materials.		Measured in-house		Demis D. John	2017-11
Al2O3 *(AJA#4)* (https://www.nanotech.ucsb.edu/wiki/index.php/Sputtering_Recipes#Al2O3_Deposition_.28Sputter_4.29)	Developer: 300 MiF	4.30	None	Most non-Al Materials.		Measured in-house		Demis D. John	2018-02
SiO2 *(PECVD #1)* (https://www.nanotech.ucsb.edu/wiki/index.php/PECVD_Recipes#SiO2_deposition_.28PECVD_.231.29)	HF ("Buffered HF Improved", Transene)	~500	None	Photoresist	High	Measured in-house	May need to increase adhesion with 100°C baked HMDS.	Biljana Stamenic	2017
SiO2 *(PECVD #2)* (https://www.nanotech.ucsb.edu/wiki/index.php/PECVD_Recipes#SiO2_deposition_.28PECVD_.232.29)	HF ("Buffered HF Improved", Transene)	~500	None	Photoresist	High	Measured in-house	May need to increase adhesion with 100°C baked HMDS.	Biljana Stamenic	2017
SiO2 (IBD) (https://www.nanotech.ucsb.edu/wiki/index.php/Sputtering_Recipes#SiO2_deposition_.28IBD.29)	HF ("Buffered HF Improved", Transene)	~350	None	Photoresist	High	Measured in-house		Biljana Stamenic	2016
Si3N4 (PECVD#1) (https://www.nanotech.ucsb.edu/wiki/index.php/PECVD_Recipes#SiN_deposition_.28PECVD_.231.29)	HF ("Buffered HF Improved", Transene)	85	None	Photoresist	High	Measured in-house		Biljana Stamenic	2018-04
Si3N4 (PECVD#2) (https://www.nanotech.ucsb.edu/wiki/index.php/PECVD_Recipes#SiN_deposition_.28PECVD_.232.29)	HF ("Buffered HF Improved", Transene)	35–45	None	Photoresist	High	Measured in-house		Biljana Stamenic	2018-05
Si3N4 Low-Stress (PECVD#2) (https://www.nanotech.ucsb.edu/wiki/index.php/PECVD_Recipes#Low-Stress_SiN_deposition_.28PECVD_.232.29)	HF ("Buffered HF Improved", Transene)	35–50	None	Photoresist	High	Measured in-house		Biljana Stamenic	2018-05
Si3N4 (IBD) (https://www.nanotech.ucsb.edu/wiki/index.php/Sputtering_Recipes#Si3N4_deposition_.28IBD.29)	HF ("Buffered HF Improved", Transene)	5–15	None	Photoresist	High	Measured in-house		Biljana Stamenic	2014
Ta2O5 (IBD) (https://www.nanotech.ucsb.edu/wiki/index.php/Sputtering_Recipes#Ta2O5_deposition_.28IBD.29)	HF ("Buffered HF Improved", Transene)	0.4	None	Photoresist	High	Measured in-house		Biljana Stamenic	2016-12
TiO2 (IBD) (https://www.nanotech.ucsb.edu/wiki/index.php/Sputtering_Recipes#TiO2_deposition_.28IBD.29)	HF ("Buffered HF Improved", Transene)	1.0–2.0	None	Photoresist	High	Measured in-house		Biljana Stamenic	2014-12
Si (<100> crystalline)	KOH (45%) @ 87°C	~730	High, Crystallographic	Si3N4 - any PECVD or LPCVD Nitride	High	Measured In-House	Use Covered, Heated vertical bath (Bay 4). Slight Bubbler.	Brian Thibeault	2017

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