Appendix 6: A list of general compatibility between general materials and processes

A list of general compatibility between most commonly used materials and most common process steps/methods. At the intersection of each etching method and material, the etch rate (in Å/min) is listed. Other comments are also included if appropriate. Symbols (NE, SC, L, and S) are explained at the end of this table.

Material / Process	Gold thin film (evaporated)	Aluminum thin film	Silicon dioxide thin film (thermally grown)	Silicon dioxide thin film (LPCVD)	Single crystal silicon (substrate)	Poly-crystal silicon (LPCVD)	Silicon nitride (LPCVD)	Parylene	Hard baked Photo-resist
Concentrated hydrofluic Acid	0	Slow (42)	Fast (23000)	Fast (14000)	0	0	Slow (140)	0	0, SC
Diluted HF (10:1)	0	Moderate (2500)	Fast (230)	Fast (340)	0	0	0	0	0, LP
KOH, 80°C	0		Slow (77)	Slow (94)	Fast (14000)	Fast (10000)	0	0	S
EDP, 90°C[1]	0 if less than 30 min		Slow (2)	Slow (2)	Fast (15000)	Fast	Slow (1)	L	S
H_3PO_4 160°C	0	Fast (9800)	Slow (0.7)	Slow (0.8)	0	0	Fast (30)	Slow (0.55), SC	S
Acetone	0	0	0	0	0	0	0	L	Fast (40000)
Photoresist developer	0	0	0	0	0	0	0	0	Fast
SF_6 plasma[2]	0, SC	0	Moderate (1200)	Moderate (1200)	Fast (5800)	Fast (5800)	Moderate (2000)	Moderate (2400)	Moderate (2400)
CF_4 plasma[3]	0	0	Slow (700)	Slow (700)	Fast (1100)	Fast (1900)	Fast (1300)	Slow	Slow (690)
Silicon DRIE recipe	0		Slow (3)	Slow (7)	Fast (1500)	Fast	Slow (21)	Slow (30)	Slow (30)
O_2 plasma	0	0	0	0	0	0	0	Slow (220[1]-1000[2])	Fast (350-3600)[4]
Gold wet etchant[5]	28	0	0	0	0	0	0	0	0
Aluminum etchant [6]	0	5500	0	0	0	0	0	0	0
XeF_2	0	0	0	0	Fast (4600)	Fast (1600)	0	L	0

[1] Transene PSE-200
[2] Approximately 200W power input.
[3] Approximately 200W power input.
[4] Depending on power input.
[5] TFA Etchant from Transene Company.
[6] Transene Aluminum Etchant (H_3PO_4 and HNO_3)

Author's Note:

This information is generally compatible with published literature, including tables in [1, 3]. However, this table is highly condensed to make it easy for beginning students.

However, the etch conditions and materials are kept generic on purpose. For example, instead of specifying four different DRIE conditions (with different gas mixture, power, pressure) as in [1], this table only considers one generic DRIE condition.

The following symbols are used to indicate material interaction:

NE: No Etch. This is different from zero etch rate. A NE status is more meaningful in some cases than indicating the etch rate is zero.
SC: May cause surface change (color, appearance), structural change, or adhesion problems.
L: long term exposure may cause structural or surface changes.
S: short term exposure may cause structural or surface changes.

Sometimes the etch rate is slow but reactions are certain. In these cases, I use L, S, or SC to represent the presence of such reactions and process risks.

1. Williams, K.R., K. Gupta, and M. Wasilik, *Etch rates for micromachining processing-Part II.* Microelectromechanical Systems, Journal of, 2003. **12**(6): p. 761-778.
2. Meng, E., P.-Y. Li, and Y.-C. Tai, *Plasma Removal of Parylene C.* Journal of Micromechanics and Microengineering, 2008. **18**: p. 045004.
3. Williams, K.R. and R.S. Muller, *Etch rates for micromachining processing.* Microelectromechanical Systems, Journal of, 1996. **5**(4): p. 256-269.